PB90-228859

Municipal Waste Combustion Multipollutant Study Emission Test Report. Maine Energy Recovery Company Refuse Derived Fuel Facility, Biddeford, Maine
Volume 3: Appendices G-N

Midwest Research Inst., Kansas City, MO

Prepared for:

Environmental Protection Agency, Research Triangle Park, NC

Jul 89

U.S. Department of Commerce
National Technical Information Service
NTIS

EPA-600/8-89-064c
July 1989

PB90-228859

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Emission Test Report

Maine Energy Recovery Company
Refuse Derived Fuel Facility
Biddeford, Maine

Volume III: Appendices G-N

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EPA Contracts 68-02-4463, W.A. 2 and
68-02-4395, W.A. 27

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U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22161

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-600/8-89-064c	2.	3. RECIPIENT'S ACCESSION NO. PB90-228859
4. TITLE AND SUBTITLE Municipal Waste Combustion, Multipollutant Study, Emission Test Report, Maine Energy Recovery Company Refure Derived Fuel Facility, Biddeford, Maine**		5. REPORT DATE July 1989
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) G. Schell, S. Klamm, M. Whitacre, and J. Surman (MRI); and W. Kelly (Radian)*		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Midwest Research Institute 425 Volker Boulevard Kansas City, Missouri 64110		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO. 68-02-4463, Task 2; 68-02-4395, Task 27
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Air and Energy Engineering Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Task Final; 12/87 - 5/88
		14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES AEERL project officer is James D. Kilgroe, Mail Drop 65, 919/541-2854. (*) Radian Corporation, P.O. Box 13000, Research Triangle Park, NC 27709. (**) Volume III. Appendices G - N.

16. ABSTRACT The report gives results of an emission test of a new municipal solid waste combustor, in Biddeford, ME, that burns refuse-derived fuel and is equipped with a lime spray dryer fabric filter (SD/FF) emission control system. Control efficiency of the SD/FF emission control system was measured for polychlorinated dibenzodioxins (PCDD), polychlorinated dibenzofurans (PCDF), particulate matter (PM), cadmium (Cd), chromium (Cr), arsenic (As), lead (Pb), mercury (Hg), sulfur dioxide (SO2), and hydrogen chloride (HCl). Additional continuous monitoring was conducted for oxygen (O2), carbon dioxide (CO2), carbon monoxide (CO), nitrogen oxides (NOx), and total hydrocarbons (THC). Average emissions of total PCDD were 290 ng/dscm (uncontrolled) and 1.3 ng/dscm (controlled). Total PCDF emissions were 590 ng/dscm (uncontrolled) and 2.9 ng/dscm (controlled). Control efficiency was about 99.5% for both dioxins and furans. Particulate emissions averaged 7400 mg/dscm (uncontrolled) and 33 mg/dscm (controlled), for an average particulate control efficiency of 99.5%. Metals emissions varied from 500 micrograms/dscm for As and Hg to 30,000 micrograms/dscm for Pb (uncontrolled), and from 6 micrograms/dscm for As and Cr to 160 micrograms/dscm for Pb (controlled). Metals control efficiencies varied from 98.2% for Hg to 99.8% for Cr.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Fabrics	Pollution Control	13B	11E
Emission	Spray Drying	Stationary Sources	14G	07A, 13H
Refuse	Calcium Oxide	Municipal Waste Combustion		07B
Wastes				
Combustion		Refuse Derived Fuel	21B	
Filters		Fabric Filters		

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 618
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

EPA Form 2220-1 (9-73)

NOTICE

This document has been reviewed in accordance with U.S. Environmental Protection Agency policy and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

ABSTRACT

This report describes the results of an emission test of a new municipal solid waste combustor which burns refuse-derived fuel and which is equipped with a lime spray dryer fabric filter (SD/FF) emission control system. The facility tested is operated by the Maine Energy Recovery Company and is located in Biddeford, Maine.

Control efficiency of the SD/FF emission control system was measured for polychlorinated dibenzodioxins (PCDD), polychlorinated dibenzofurans (PCDF), particulate matter (PM), cadmium (Cd), chromium (Cr), arsenic (As), lead (Pb), mercury (Hg), sulfur dioxide (SO_2), and hydrogen chloride (HCl). Additional continuous monitoring was conducted at various locations for oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxides (NO_X), and total hydrocarbons (THC). Process samples were also collected and analyzed for metals and selected physical properties.

Average emissions of total PCDD were 290 ng/dscm (0.1×10^{-6} gr/dscf) (uncontrolled) and 1.3 ng/dscm (5.7×10^{-10} gr/dscf) (controlled). Total PCDF emissions were 590 ng/dscm (0.3×10^{-6} gr/dscf) (uncontrolled) and 2.9 ng/dscm (1.3×10^{-9} gr/dscf) (controlled). The control efficiency was about 99.5% for both dioxins and furans. All of the above results are corrected to 12% CO_2. The 17 specific PCDD/PCDF isomers, as well as the tetra through octa chlorinated total congeners, showed no significant change in distribution across the control device.

Uncontrolled particulate emissions averaged 7,400 mg/dscm (3.23 gr/dscf), and controlled particulates averaged 33 mg/dscm (0.01 gr/dscf) (corrected to 12% CO_2) for an average particulate control efficiency of 99.5%.

Metals emissions (uncontrolled) varied from 500 µg/dscm for arsenic and mercury to 30,000 µg/dscm for lead. Controlled metals emissions varied from 6 µg/dscm for arsenic and chromium to 160 µg/dscm for lead. Metals control efficiencies varied from 98.2% for mercury to 99.8% for chromium. The process ash sample results were in general agreement with the concentrations measured in the stack samples.

The continuous monitoring results and process data logging indicated that the combustion process was never under optimum operating conditions. There were frequent problems with feeder conveyors during all three test runs. CO concentrations averaged 70 ppm with some short duration excursions above 200 ppm.

The automatic SD/FF control system was not operating during these tests. During the first test, the stoichiometric lime-to-HCl + SO_2 ratio was 1.7, which resulted in an SO_2 removal efficiency of 66% and an HCl removal efficiency of 98%. During the early stages of the second test, the lime feed rate was doubled to give a stoichiometric ratio of 3.4. During the third test the stoichiometric ratio was 3.9 and removal efficiencies were improved to 90% for SO_2 and 99.4% for HCl.

This report was submitted in fulfillment of Contract 68-02-4463, Work Assignment No. 2 and Contract 68-02-4395, Work Assignment No. 27 by Midwest Research Institute under the sponsorship of the U.S. Environmental Protection Agency. This report covers tests performed during the period from December 8 to 12, 1987. Project work was completed as of May 1, 1988.

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APPENDIX G

LABORATORY ANALYSIS PCDDs/PCDFs

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G.1 Summary Tables

TABLE G-1. MERC UNCONTROLLED FLUE GAS CDD/CDF RESULTS (ng/sample)

Isomer	Run 1			Run 2			Run 3		
	Front half	Back half	Total 1	Front half	Back half	Total 2	Front half	Back half	Total 3
2,3,7,8-TCDD	1.37	0.00978[a]	1.37	4.40	0.00575[a]	4.40	2.97	0.00946[a]	2.97
Other TCDD	61.0	0.0523	61.1	119	0.0897	119	95.5	0.0384	95.5
1,2,3,7,8-PeCDD	7.38	0.0190[a]	7.38	12.8	0.0106[a]	12.8	9.87	0.0195[a]	9.87
Other PeCDD	66.5	0.0190[a]	66.5	130	0.00878[a]	130	123	0.0195[a]	123
1,2,3,4,7,8-HxCDD	7.69	0.0242[a]	7.69	15.9	0.0112[a]	15.9	11.9	0.0115[a]	11.9
1,2,3,6,7,8-HxCDD	15.3	0.0326[a]	15.3	31.6	0.0324[a]	31.6	22.8	0.0154[a]	22.8
1,2,3,7,8,9-HxCDD	12.6	0.0192[a]	12.6	27.2	0.00980[a]	27.2	20.0	0.00910[a]	20.0
Other HxCDD	74.4	0.0192[a]	74.4	157	0.0104[a]	157	123	0.00910[a]	123
1,2,3,4,6,7,8-HpCDD	46.3	0.0453[a]	46.3	78.0	0.0340[a]	78.0	67.3	0.0222[a]	67.3
Other HpCDD	40.3	0.0453[a]	40.3	72.0	0.0340[a]	72.0	62.7	0.0222[a]	62.7
Octa-CDD	77.5	0.0698	77.6	128	0.113	128	96.0	0.104	96.1
Total PCDDs	410	0.1221	410	776	0.2027	776	635	0.1424	636
2,3,7,8-TCDF	54.4	0.0121	54.4	91.2	0.0230	91.22	63.6	0.0174	63.6
Other TCDF	376	0.00	376	545	0.0490	545	378	0.0203	378
1,2,3,4,8-PeCDF	5.55	0.00778[a]	5.55	11.0	0.00537[a]	11.0	6.97	0.00622[a]	6.97
1,2,3,7,8-PeCDF	26.8	0.00924[a]	26.8	41.3	0.00809[a]	41.3	26.1	0.00740[a]	26.1
2,3,4,7,8-PeCDF	26.2	0.0174[a]	26.2	43.6	0.00726[a]	43.6	29.0	0.0142[a]	29.0
Other PeCDF	246	0.0219	247	386	0.0259	386	278	0.0105[a]	278

(continued)

TABLE G-1 (continued)

Isomer	Run 1			Run 2			Run 3		
	Front half	Back half	Total 1	Front half	Back half	Total 2	Front half	Back half	Total 3
1,2,3,4,7,8-HxCDF	31.0	0.00816[a]	31.0	50.4	0.00871[a]	50.4	39.7	0.00931[a]	39.7
1,2,3,6,7,8-HxCDF	18.2	0.00748[a]	18.2	31.5	0.00800[a]	31.5	20.6	0.00924[a]	20.6
1,2,3,4,7,9-HxCDF	3.83	0.0124[a]	3.83	6.72	0.0133[a]	6.72	4.93	0.0154[a]	4.93
2,3,4,6,7,8-HxCDF	15.7	0.00718[a]	15.7	15.0	0.00504[a]	15.0	26.2	0.00729[a]	26.2
1,2,3,7,8,9-HxCDF	3.87	0.0254[a]	3.87	3.11	0.00533[a]	3.11	2.34	0.00798[a]	2.34
Other HxCDF	99.4	0.00866[a]	99.4	144	0.0134	144	122	0.00779[a]	122
1,2,3,4,6,7,8-HpCDF	58.9	0.0122[a]	58.9	83.8	0.0143[a]	83.8	68.2	0.0192[a]	68.2
1,2,3,4,7,8,9-HpCDF	9.39	0.0138[a]	9.39	14.1	0.0162[a]	14.1	12.9	0.0201[a]	12.9
Other HpCDF	24.1	0.0122[a]	24.1	38.1	0.0143[a]	38.1	32.9	0.0133[a]	32.9
Octa-CDF	21.8	0.0246[a]	21.8	35.4	0.0231[a]	35.4	30.6	0.0348[a]	30.6
Total PCDFs	1,021	0.0340	1,021	1,540	0.111	1,540	1,142	0.0377	1,143
Total PCDD + PCDF	1,431	0.1561	1,432	2,316	0.314	2,317	1,778	0.1801	1,778
Sample volume (dscm)	1.89			3.0			1.97		

[a] Denote detection limits of undetected compounds, which are considered as zeroes in calculating totals.

TABLE G-2. MERC CONTROLLED FLUE GAS CDD/CDF RESULTS (ng/sample)

Isomer	Run 1	Run 2	Run 3
2,3,7,8-TCDD	0.0465	0.174	0.0227[a]
Other TCDD	0.632	0.976	0.228
1,2,3,7,8-PeCDD	0.0704	0.117	0.0491
Other PeCDD	0.646	1.76	0.244
1,2,3,4,7,8-HxCDD	0.0748	0.122	0.0472
1,2,3,6,7,8-HxCDD	0.144	0.268	0.0874
1,2,3,7,8,9-HxCDD	0.124	0.237	0.0738
Other HxCDD	0.769	1.20	0.270
1,2,3,4,6,7,8-HpCDD	0.509	0.904	0.269
Other HpCDD	0.457	0.786	0.237
Octa-CDD	1.04	1.65	0.573
Total PCDDs	4.51	8.19	2.08
2,3,7,8-TCDF	0.516	0.793	0.303
Other TCDF	3.17	4.84	1.61
1,2,3,4,8-PeCDF	0.0612	0.0929	0.0240
1,2,3,7,8-PeCDF	0.239	0.366	0.0934
2,3,4,7,8-PeCDF	0.237	0.333	0.117
Other PeCDF	2.50	3.55	1.13
1,2,3,4,7,8-HxCDF	0.325	0.503	0.189
1,2,3,6,7,8-HxCDF	0.174	0.288	0.0929
1,2,3,4,7,9-HxCDF	0.0504	0.0348	0.0749[a]
2,3,4,6,7,8-HxCDF	0.195	0.214	0.0906
1,2,3,7,8,9-HxCDF	0.0183	0.0318	0.0222[a]
Other HxCDF	1.02	1.61	0.470
1,2,3,4,6,7,8-HpCDF	0.602	0.932	0.325
1,2,3,4,7,8,9-HpCDF	0.118	0.196	0.0705
Other HpCDF	0.247	0.372	0.125
Octa-CDF	0.255	3.63	0.126
Total PCDFs	9.67	17.8	4.77
Total PCDD + PCDF	14.2	26.0	6.85
Sample volume (dscm)	3.59	5.67	2.14

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[a] Denotes minimum detection limits of undetected compounds, which are considered as zeros in calculating totals.

Run 1 is the average of two analyses (trial 1 and trial 2).

TABLE G-3. UNCONTROLLED FLUE GAS CDD/CDF RESULTS FOR MERC (ng/dscm)
(FRONT HALF, BACK HALF, AND TOTAL FRACTION RESULTS

Isomer	Run 1		Total 1	Run 2		Total 2	Run 3		Total 3
	Front half	Back half		Front half	Back half		Front half	Back half	
2,3,7,8-TCDD	0.725	0.005[a]	0.725	1.47	0.002[a]	1.47	1.51	0.005[a]	1.51
Other TCDD	32.3	0.028	32.3	39.5	0.030	39.6	48.5	0.019	48.5
1,2,3,7,8-PeCDD	3.90	0.010[a]	3.90	4.27	0.004[a]	4.27	5.01	0.010[a]	5.01
Other PeCDD	35.2	0.010[a]	35.2	43.4	0.003[a]	43.4	62.5	0.010[a]	62.5
1,2,3,4,7,8-HxCDD	4.07	0.013[a]	4.07	5.30	0.004[a]	5.30	6.04	0.006[a]	6.04
1,2,3,6,7,8-HxCDD	8.10	0.017[a]	8.10	10.5	0.011[a]	10.5	11.6	0.008[a]	11.6
1,2,3,7,8,9-HxCDD	6.67	0.010[a]	6.67	9.07	0.003[a]	9.07	10.2	0.005[a]	10.2
Other HxCDD	39.4	0.010[a]	39.4	52.4	0.003[a]	52.4	63.6	0.005[a]	63.6
1,2,3,4,6,7,8-HpCDD	24.5	0.024[a]	24.5	26.0	0.011[a]	26.0	34.2	0.011[a]	34.2
Other HpCDD	21.3	0.024[a]	21.3	24.0	0.011[a]	24.0	31.8	0.011[a]	31.8
Octa-CDD	41.0	0.037	41.0	42.7	0.038	42.7	48.7	0.053	48.8
Total PCDDs	217	0.064	217	259	0.068	259	324	0.072	324
2,3,7,8-TCDF	28.8	0.006	28.8	30.4	0.008	30.4	32.3	0.009	32.3
Other TCDF	199	0.000	199	182	0.016	182	192	0.010	192
1,2,3,4,8-PeCDF	2.94	0.004[a]	2.94	3.67	0.002[a]	3.67	3.54	0.003[a]	3.54
1,2,3,7,8-PeCDF	14.2	0.005[a]	14.2	13.8	0.003[a]	13.8	13.2	0.004[a]	13.2
2,3,4,7,8-PeCDF	13.9	0.009[a]	13.9	14.5	0.002[a]	14.5	14.7	0.007[a]	14.7
Other PeCDF	130	0.012	130	129	0.009	129	141	0.005[a]	141

(continued)

TABLE G-3 (continued)

Isomer	Run 1 Front half	 Back half	Total 1	Run 2 Front half	 Back half	Total 2	Run 3 Front half	 Back half	Total 3
1,2,3,4,7,8-HxCDF	16.4	0.004[a]	16.4	16.8	0.003[a]	16.8	20.2	0.005[a]	20.2
1,2,3,6,7,8-HxCDF	9.63	0.004[a]	9.63	10.5	0.003[a]	10.5	10.5	0.005[a]	10.5
1,2,3,4,7,9-HxCDF	2.03	0.007[a]	2.03	2.24	0.004[a]	2.24	2.50	0.008[a]	2.50
2,3,4,6,7,8-HxCDF	8.31	0.004[a]	8.31	5.00	0.002[a]	5.00	13.3	0.004[a]	13.3
1,2,3,7,8,9-HxCDF	2.05	0.013[a]	2.05	1.04	0.002[a]	1.04	1.19	0.004[a]	1.19
Other HxCDF	52.6	0.005[a]	52.6	48.1	0.004	48.1	62.0	0.004[a]	62.0
1,2,3,4,6,7,8-HpCDF	31.2	0.006[a]	31.2	27.9	0.005[a]	27.9	34.6	0.010[a]	34.6
1,2,3,4,7,8,9-HpCDF	4.97	0.007[a]	4.97	4.70	0.005[a]	4.70	6.55	0.010[a]	6.55
Other HpCDF	12.8	0.006[a]	12.8	12.7	0.005[a]	12.7	16.7	0.007[a]	16.7
Octa-CDF	11.5	0.013[a]	11.5	11.8	0.008[a]	11.8	15.5	0.018[a]	15.5
Total PCDFs	540	0.018	540	513	0.037	514	580	0.019	580
Total PCDD + PCDF	757	0.082	757	772	0.105	772	904	0.091	904

[a] Denote minimum detection limits of undetected compounds, which are considered as zeroes in calculating totals.

TABLE G-4. MERC CONTROLLED FLUE GAS CDD/CDF RESULTS (ng/dscm)

Isomer	Run 1	Run 2	Run 3
2,3,7,8-TCDD	0.0130	0.0307	0.0106[a]
Other TCDD	0.176	0.172	0.107
1,2,3,7,8-PeCDD	0.0196	0.0206	0.0229
Other PeCDD	0.180	0.310	0.114
1,2,3,4,7,8-HxCDD	0.0208	0.0215	0.0221
1,2,3,6,7,8-HxCDD	0.0400	0.0473	0.0408
1,2,3,7,8,9-HxCDD	0.0345	0.0418	0.0345
Other HxCDD	0.214	0.212	0.126
1,2,3,4,6,7,8-HpCDD	0.142	0.159	0.126
Other HpCDD	0.127	0.139	0.111
Octa-CDD	0.289	0.291	0.268
Total PCDDs	1.26	1.44	0.972
2,3,7,8-TCDF	0.144	0.140	0.142
Other TCDF	0.883	0.854	0.752
1,2,3,4,8-PeCDF	0.0170	0.0164	0.0112
1,2,3,7,8-PeCDF	0.0664	0.0646	0.0436
2,3,4,7,8-PeCDF	0.0659	0.0587	0.0547
Other PeCDF	0.697	0.626	0.528
1,2,3,4,7,8-HxCDF	0.0904	0.0887	0.0883
1,2,3,6,7,8-HxCDF	0.0483	0.0508	0.0434
1,2,3,4,7,9-HxCDF	0.0140	0.0061	0.0350
2,3,4,6,7,8-HxCDF	0.0543	0.0377	0.0423
1,2,3,7,8,9-HxCDF	0.0051	0.0056	0.0104
Other HxCDF	0.284	0.284	0.220
1,2,3,4,6,7,8-HpCDF	0.168	0.164	0.152
1,2,3,4,7,8,9-HpCDF	0.0327	0.0346	0.0329
Other HpCDF	0.0687	0.0656	0.0584
Octa-CDF	0.0710	0.640	0.0589
Total PCDFs	2.69	3.14	2.23
Total PCDD + PCDF	3.96	4.59	3.20
Sample volume (dscm)	3.59	5.67	2.14

[a] Denotes minimum detection limits of undetected compounds, which are considered as zeros in calculating totals.

Run 1 is the average of two analyses (trial 1 and trial 2).

G.2 Quantitation Report Sheets

DF101113

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X9
SAMPLE ID: 1011-1013 (FRONT HALF INLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1853	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1753340	NA	2.35	NA
2782	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	3102110	NA	4.90	NA
1781	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	877152	0.608		50.7
2298	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1616830	1.425		58.1
2670	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.400	2790520	2.986		60.3
2941	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1740280	2.718		56.0
1881	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	592117	0.586		46.9
2416	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	847176	1.460		58.9
2755	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1588770	2.668		54.5
3022	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	1180520	2.991		61.0
3267	13C-OCDD	470/472 (87/100)	472	0.605	2851710	7.451		60.6
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	505491000* ✓		267	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	207149400* ✓		138	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	217805306		172	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	79013140		92.4	
3276	OCTA-CDF	442/444 (87/100)	442+444	2.192	11065590		21.8	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	69991667		62.4	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	73534118		73.9	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	82702432		110	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	63351000		86.6	
3267	OCTA-CDD	458/460 (87/100)	458+460	2.044	36731000		77.5	

*SEE ADDITIONAL SPREADSHEET FOR DILUTIONS

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: Mike Holley DATE: 3/23/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/16/88 REVIEWED: Mike Holley DATE: 3/23/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/16/88 REVIEWED:__________ DATE:________

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PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X9
SAMPLE ID: 1011-1013 (FRONT HALF INLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1783	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	*		0.000	
2284	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	8654460		5.55	
2292	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	35113400		26.8	
2376	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	39239800		26.2	
2672	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	40755100		31.0	
2682	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	26157700		18.2	
2692	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	3306870		3.83	
2735	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	19862880		15.7	
2799	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	4473390		3.87	
2943	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	50379600		58.9	
3056	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	7057500		9.39	
3274	OCTA-CDF	442/444 (87/100)	442+444	2.192	11065590		21.8	
1883	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	1534416		1.37	
2418	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	7341010		7.38	
2747	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	4603540		7.69	
2757	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	6793140		15.3	
2784	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	9517620		12.6	
3024	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	33842900		46.3	
3269	OCTA-CDD	458/460 (87/100)	458+460	2.044	36731000		77.5	

*SEE ADDITIONAL SPREADSHEET FOR DILUTIONS

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: Mike Molloy DATE: 3/23/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/16/88 REVIEWED: Mike Molloy DATE: 3/23/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/16/88 REVIEWED:__________ DATE:________

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PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910C18X1
SAMPLE ID: 1011-1013 1:5 DILUTION

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.82 ng
13C-1,2,3,7,8,9-HxCDD	5.88 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	0.24 NG
13C-1,2,3,7,8-PeCDF	0.49 NG
13C-1,2,3,4,7,8-HxCDF	0.99 NG
13C-1,2,3,4,6,7,8-HpCDF	0.97 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	0.25 NG
13C-1,2,3,7,8-PeCDD	0.50 NG
13C-1,2,3,6,7,8-HxCDD	0.98 NG
13C-1,2,3,4,6,7,8-HpCDD	0.98 NG
13C-OCDD	2.46 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)*DIL.

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1693	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1544158	NA	2.82	NA
2694	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2446870	NA	5.88	NA
1629	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	186470	0.176		73.4
2165	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	275000	0.330		67.4
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	65730240		163	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	42669584		167	

GC/MS ANALYST: D. MILLS   ANALYSIS DATE: 3/18/88   DATA ENTRY REVIEWED: ______ DATE: 3/23/88
DATA ANALYST: M. WHITACRE   ANALYSIS DATE: 3/23/88   REVIEWED: ______ DATE: 3/23/88
DATA ENTRY: M. WHITACRE   ENTRY DATE: 3/23/88   REVIEWED: ______ DATE: ______

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PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)*DIL.

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910C10X1
SAMPLE ID: 1011-1013 1:5 DILUTION

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 2.82 ng
13C-1,2,3,7,8,9-HxCDD 5.88 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF 0.24 NG
13C-1,2,3,7,8-PeCDF 0.49 NG
13C-1,2,3,4,7,8-HxCDF 0.99 NG
13C-1,2,3,4,6,7,8-HpCDF 0.97 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD 0.25 NG
13C-1,2,3,7,8-PeCDD 0.50 NG
13C-1,2,3,6,7,8-HxCDD 0.98 NG
13C-1,2,3,4,6,7,8-HpCDD 0.98 NG
13C-OCDD 2.46 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1631	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	21932980		54.4	

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 3/10/88 DATA ENTRY REVIEWED: Mike Molloy DATE: 3/23/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/23/88 REVIEWED: Mike Molloy DATE: 3/23/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/23/88 REVIEWED:__________ DATE:________

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PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X1
SAMPLE ID: 1014-1016 (BACK HALF INLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1031	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1189930	NA	2.35	NA
2759	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	1670430	NA	4.90	NA
1760	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	540200	0.552		46.0
2268	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	929096	1.206		49.2
2640	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	1452250	2.878		58.1
2920	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	901400	2.623		54.1
1857	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	372669	0.544		43.5
2394	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	444216	1.128		45.5
2733	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	892488	2.784		56.8
3004	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	550895	2.592		52.9
3249	13C-OCDD	470/472 (87/100)	472	0.605	1226920	5.953		48.4
1760	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	14100		0.0121	
2309	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	18856		0.0219	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	5687	NDK	0.00866	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	5400	NDK	0.0122	
NA	OCTA-CDF	442/444 (87/100)	442+444	2.192	5374	NDK	0.0246	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	36915		0.0523	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	9897	NDK	0.0190	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	8148	NDK	0.0192	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	15462	NDK	0.0453	
3249	OCTA-CDD	458/460 (87/100)	458+460	2.044	14224		0.0698	

GC/MS ANALYST:	R. ROBSON	ANALYSIS DATE:	1/31/88	DATA ENTRY REVIEWED: Mike Kelly	DATE: 3/21/88
DATA ANALYST:	M. WHITACRE	ANALYSIS DATE:	3/10/88	REVIEWED: Mike Kelly	DATE: 3/21/88
DATA ENTRY:	M. WHITACRE	ENTRY DATE:	3/10/88	REVIEWED:__________	DATE:______

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PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910831X1
SAMPLE ID: 1014-1016 (BACK HALF INLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1762	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	14100		0.0121	
2262	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	6968	NOK	0.00778	
2270	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	6968	NOK	0.00924	
2354	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	14952	NOK	0.0174	
2650	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	5569	NOK	0.00816	
2660	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	5569	NOK	0.00748	
2670	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	5569	NOK	0.0124	
2713	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	4714	NOK	0.00718	
2777	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	15256	NOK	0.0254	
2922	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	5400	NOK	0.0122	
3035	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	5400	NOK	0.0138	
3256	OCTA-CDF	442/444 (87/100)	442+444	2.192	5374	NOK	0.0246	
1859	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	6901	NOK	0.00978	
2396	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	9897	NOK	0.0190	
2725	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	8148	NOK	0.0242	
2735	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	8148	NOK	0.0326	
2762	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	8148	NOK	0.0192	
3006	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	15462	NOK	0.0453	
3251	OCTA-CDD	458/460 (87/100)	458+460	2.044	14224		0.0698	

GC/MS ANALYST: R. ROBSON   ANALYSIS DATE: 1/31/88   DATA ENTRY REVIEWED: Mike [illegible] DATE: 3/21/88
DATA ANALYST: M. WHITACRE   ANALYSIS DATE: 3/10/88   REVIEWED: Mike [illegible] DATE: 3/21/88
DATA ENTRY: M. WHITACRE   ENTRY DATE: 3/10/88   REVIEWED:__________ DATE:_______

DF201113

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X10
SAMPLE ID: 2011-2013 (FRONT HALF INLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1864	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1658870	NA	2.35	NA
2785	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2559610	NA	4.90	NA
1792	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	888858	0.651		54.3
2297	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1271950	1.185		48.3
2674	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2192250	2.835		57.3
2944	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1415910	2.680		55.3
1890	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	574240	0.601		48.1
2423	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	788720	1.437		57.9
2758	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1317720	2.682		54.7
3025	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	948008	2.911		59.4
3269	13C-OCDD	470/472 (87/100)	472	0.605	2030040	6.428		52.3
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	563088609		293	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	184593362		156	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	297612358		209	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	94703420		136	
3279	OCTA-CDF	442/444 (87/100)	442+444	2.192	12805560		35.4	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	133922370		123	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	132149590		143	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	145080520		232	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	88337500		150	
3270	OCTA-CDD	458/460 (87/100)	458+460	2.044	43262100		128	

*SEE ADDITIONAL SPREADSHEET FOR DILUTIONS

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: DATE: 3/22/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/16/88 REVIEWED: DATE: 3/22/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/16/88 REVIEWED:________ DATE:________

DF201113

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X10
SAMPLE ID: 2011-2013 (FRONT HALF INLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1794	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	*		0.000	
2291	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	13468150		11.0	
2299	1,2,3,7,8-PENTA-CDF	338/346 (61/100)	338+340	1.988	42639000		41.3	
2383	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	*		0.000	
2676	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	51930000		50.4	
2686	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	35377000		31.5	
2696	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	4546290		6.72	
2739	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	14897000		15.03	
2803	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	2815540		3.11	
2946	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	58301300		83.8	
3059	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	8635460		14.1	
3276	OCTA-CDF	442/444 (87/100)	442+444	2.192	12805560		35.4	
1892	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	4788400		4.40	
2425	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	11841200		12.8	
2750	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	7880660		15.9	
2760	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	11666040		31.6	
2787	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	17028210		27.2	
3827	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	45841100		78.0	
3271	OCTA-CDD	458/460 (87/100)	458+460	2.044	43262100		128	

*SEE ADDITIONAL SPREADSHEET FOR DILUTIONS

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: DATE: 3/22/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/16/88 REVIEWED: DATE: 3/22/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/16/88 REVIEWED:________ DATE:________

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PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910C18X2
SAMPLE ID: 2011-2013 1:5 DILUTION

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.82 ng
13C-1,2,3,7,8,9-HxCDD	5.88 ng

MET°°C INTERNAL STANDARDS

13C-2,3,7,8-TCDF	0.24 NG
13C-1,2,3,7,8-PeCDF	0.49 NG
13C-1,2,3,4,7,8-HxCDF	0.99 NG
13C-1,2,3,4,6,7,8-HpCDF	0.97 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	0.25 NG
13C-1,2,3,7,8-PeCDD	0.50 NG
13C-1,2,3,6,7,8-HxCDD	0.98 NG
13C-1,2,3,4,6,7,8-HpCDD	0.98 NG
13C-OCDD	2.46 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)*DIL.

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1693	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1466270	NA	2.82	NA
2692	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2933690	NA	5.88	NA
1629	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	226213	0.225		93.8
2164	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	384456	0.486		99.2
2575	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	757632	1.026		103.6
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	167533210		343	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	109777618		308	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	28957200		42	

GC/MS ANALYST:	D. MILLS	ANALYSIS DATE:	3/18/88	DATA ENTRY REVIEWED: Mike Milby	DATE: 3/23/88
DATA ANALYST:	M. WHITACRE	ANALYSIS DATE:	3/23/88	REVIEWED: Mike Milby	DATE: 3/23/88
DATA ENTRY:	M. WHITACRE	ENTRY DATE:	3/23/88	REVIEWED:__________	DATE:________

DF2011DX

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)*DIL.

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910C18X2
SAMPLE ID: 2011-2013 1:5 DILUTION

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 2.82 ng
13C-1,2,3,7,8,9-HxCDD 5.88 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF 0.24 NG
13C-1,2,3,7,8-PeCDF 0.49 NG
13C-1,2,3,4,7,8-HxCDF 0.99 NG
13C-1,2,3,4,6,7,8-HpCDF 0.97 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD 0.25 NG
13C-1,2,3,7,8-PeCDD 0.50 NG
13C-1,2,3,6,7,8-HxCDD 0.98 NG
13C-1,2,3,4,6,7,8-HpCDD 0.98 NG
13C-OCDD 2.46 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/20/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1631	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	44588000		91.2	
2262	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	15556850		43.6	

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 3/18/88 DATA ENTRY REVIEWED: Mike Mills DATE: 3/23/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/23/88 REVIEWED: Mike Mills DATE: 3/23/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/23/88 REVIEWED:__________ DATE:________

DF201416

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X2
SAMPLE ID: 2014-2016 (BACK HALF INLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1829	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1527190	NA	2.35	NA
2757	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2322010	NA	4.90	NA
1759	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	786632	0.626		52.2
2264	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1315650	1.331		54.3
2645	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2118630	3.020		61.0
2919	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1350520	2.818		58.1
1856	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	625396	0.711		56.9
2392	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	672844	1.331		53.7
2730	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1282350	2.877		58.7
3002	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	812048	2.748		56.1
3247	13C-OCDD	470/472 (87/100)	472	0.605	1865350	6.511		52.9
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	122343		0.0720	
2166	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	31646		0.0259	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	12844		0.0134	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2,383	9457	NDC	0.0143	
NA	OCTA-CDF	442/444 (87/100)	442+444	2.192	7684	NDC	0.0231	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	106268		0.0897	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	6941	NDC	0.00878	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	6297	NDC	0.0104	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	17124	NDC	0.0340	
3247	OCTA-CDD	458/460 (87/100)	458+460	2.044	35170		0.113	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: Mike Molloy DATE: 3/22/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/10/88 REVIEWED: Mike Molloy DATE: 3/22/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/10/88 REVIEWED:__________ DATE:________

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X2
SAMPLE ID: 2014-2016 (BACK HALF INLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1761	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	39175		0.0230	
2258	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	6809	NDK	0.00537	
2266	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	8631	NDK	0.00809	
2350	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	8855	NDK	0.00726	
2647	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	8681	NDK	0.00871	
2657	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	8681	NDK	0.00800	
2667	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	8681	NDK	0.0133	
2710	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	4027	NDK	0.00504	
2774	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	4663	NDK	0.00533	
2921	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	9457	NDK	0.0143	
3034	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	9457	NDK	0.0162	
3254	OCTA-CDF	442/444 (87/100)	442+444	2.192	7684	NDK	0.0231	
1858	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	6814	NDK	0.00575	
2394	1,2;3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	8386	NDK	0.0106	
2722	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	5436	NDK	0.0112	
2732	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	11634	NDK	0.0324	
2759	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	5964	NDK	0.00980	
3004	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	17124	NDK	0.0348	
3249	OCTA-CDD	458/460 (87/100)	458+460	2.044	35170		0.113	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: Mike Smith DATE: 3/22/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/10/88 REVIEWED: Mike Smith DATE: 3/22/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/10/88 REVIEWED:____________ DATE:________

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PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X11
SAMPLE ID: 3011-3013 (FRONT HALF INLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.98 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1854	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	2140890	NA	2.35	NA
2781	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	3817340	NA	4.90	NA
1782	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	985008	0.558		46.5
2298	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1863270	1.340		54.7
2678	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.498	2969750	2.575		52.0
2941	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1951960	2.477		51.1
1879	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	713792	0.577		46.1
2416	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	968368	1.362		54.9
2755	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1840120	2.512		51.3
3022	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	1243290	2.560		52.2
3267	13C-OCDD	470/472 (87/100)	472	0.605	3257720	6.917		56.2
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	573145582*4		269	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	262749475*5		152	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	289977090		216	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	109532800		114	
3276	OCTA-CDF	442/444 (87/100)	442+444	2.192	17783030		30.6	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	133177820		98.5	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	151594530		133	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	155139870		178	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	100257000		130	
3268	OCTA-CDD	458/460 (87/100)	458+460	2.044	51916900		96	

*SEE ADDITIONAL SPREADSHEET FOR DILUTIONS

GC/MS ANALYST: R. RGBSON   ANALYSIS DATE: 1/30/88   DATA ENTRY REVIEWED: ____ DATE: 3/22/88

DATA ANALYST: M. WHITACRE   ANALYSIS DATE: 3/11/88   REVIEWED: ____ DATE: 3/22/88

DATA ENTRY: M. WHITACRE   ENTRY DATE: 3/11/88   REVIEWED: ____ DATE: ____

0F301113

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X11
SAMPLE ID: 3011-3013 (FRONT HALF INLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 2.35 ng
13C-1,2,3,7,8,9-HxCDD 4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF 1.20 NG
13C-1,2,3,7,8-PeCDF 2.45 NG
13C-1,2,3,4,7,8-HxCDF 4.95 NG
13C-1,2,3,4,6,7,8-HpCDF 4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD 1.25 NG
13C-1,2,3,7,8-PeCDD 2.48 NG
13C-1,2,3,6,7,8-HxCDD 4.90 NG
13C-1,2,3,4,6,7,8-HpCDD 4.90 NG
13C-OCDD 12.3 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1784	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	*		0.000	
2284	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	12519930		6.97	
2292	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	39428000		26.1	
2376	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	*		0.000	
2672	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	55450000		39.7	
2682	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	31414700		20.6	
2692	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	4519150		4.93	
2735	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	35129800		26.2	
2799	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	2869880		2.34	
2943	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	65403300		68.2	
3056	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	10893300		12.9	
3274	OCTA-CDF	442/444 (87/100)	442+444	2.192	17783030		30.6	
1881	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	4017050		2.97	
2418	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	11226100		9.87	
2747	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	8263990		11.9	
2757	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	11760370		22.8	
2784	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	17456880		20.0	
3024	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	51867500		67.3	
3269	OCTA-CDD	458/460 (87/100)	458+460	2.044	51916900		96	

*SEE ADDITIONAL SPREADSHEET FOR DILUTIONS

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: Mike Molloy DATE: 3/22/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/11/88 REVIEWED: Mike Molloy DATE: 3/22/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/11/88 REVIEWED:________ DATE:________

DF3011DX

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910C18X3
SAMPLE ID: 3011-3013 1:5 DILUTION

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 2.82 ng
13C-1,2,3,7,8,9-HxCDD 5.88 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF 0.24 NG
13C-1,2,3,7,8-PeCDF 0.49 NG
13C-1,2,3,4,7,8-HxCDF 0.99 NG
13C-1,2,3,4,6,7,8-HpCDF 0.97 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD 0.25 NG
13C-1,2,3,7,8-PeCDD 0.50 NG
13C-1,2,3,6,7,8-HxCDD 0.98 NG
13C-1,2,3,4,6,7,8-HpCDD 0.98 NG
13C-OCDD 2.46 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)*DIL.

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1691	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1052700	NA	2.82	NA
2692	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	3041080	NA	5.88	NA
1628	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	210626	0.166		69.1
2178	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	377780	0.378		77.1
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	78725890		173	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	65828080		188	

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 3/18/88 DATA ENTRY REVIEWED: DATE: 3/23/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/23/88 REVIEWED: DATE: 3/23/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/23/88 REVIEWED:__________ DATE:________

DF3011DX

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)*DIL.

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910C18X3
SAMPLE ID: 3011-3013 1:5 DILUTION

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.82 ng
13C-1,2,3,7,8,9-HxCDD	5.88 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	0.24 NG
13C-1,2,3,7,8-PeCDF	0.49 NG
13C-1,2,3,4,7,8-HxCDF	0.99 NG
13C-1,2,3,4,6,7,8-HpCDF	0.97 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	0.25 NG
13C-1,2,3,7,8-PeCDD	0.50 NG
13C-1,2,3,6,7,8-HxCDD	0.98 NG
13C-1,2,3,4,6,7,8-HpCDD	0.98 NG
13C-OCDD	2.46 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1631	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	28938200		63.6	
2229	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	10171380		23.0	

GC/MS ANALYST: D. HILLS ANALYSIS DATE: 3/18/88 DATA ENTRY REVIEWED: Mike Molly DATE: 3/22/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/23/88 REVIEWED: Mike Molly DATE: 3/23/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/23/88 REVIEWED:__________ DATE:________

0F301416

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X3
SAMPLE ID: 3014-3016 (BACK HALF INLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1829	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1303070	NA	2.35	NA
2756	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2148070	NA	4.90	NA
1758	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	620704	0.579		48.2
2264	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1154410	1.369		55.9
2644	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	1936720	2.984		60.3
2917	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1230170	2.774		57.2
1856	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	557688	0.743		59.4
2391	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	591128	1.371		55.3
2729	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1132310	2.746		56.0
3000	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	751080	2.748		56.1
3245	13C-OCDD	470/472 (87/100)	472	0.605	1732220	6.536		53.1
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	50646		0.0377	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	11230	NDK	0.0105	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	6825	NDK	0.00779	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	8063	NDK	0.0133	
NA	OCTA-CDF	442/444 (87/100)	442+444	2.192	10747	NDK	0.0348	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	40553		0.0384	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	13513	NDK	0.0195	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	4887	NDK	0.00910	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	10313	NDK	0.0222	
3246	OCTA-CDD	458/460 (87/100)	458+460	2.044	30048		0.104	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: DATE: 3/21/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/10/88 REVIEWED: DATE: 3/21/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/10/88 REVIEWED:__________ DATE:________

DF301416

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X3
SAMPLE ID: 3014-3016 (BACK HALF INLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1760	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	23394		0.0174	
2258	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	6928	NOK	0.00622	
2266	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	6928	NOK	0.00740	
2350	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	15203	NOK	0.0142	
2646	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	8476	NOK	0.00931	
2656	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	9173	NOK	0.00924	
2666	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	9173	NOK	0.0154	
2709	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	6383	NOK	0.00729	
2773	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	6383	NOK	0.00798	
2919	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	11577	NOK	0.0192	
3032	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	10662	NOK	0.0201	
3252	OCTA-CDF	442/444 (87/100)	442+444	2.192	10747	NOK	0.0348	
1858	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	9993	NOK	0.00946	
2393	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	13513	NOK	0.0195	
2721	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	4887	NOK	0.0115	
2731	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	4887	NOK	0.0154	
2758	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	4887	NOK	0.00910	
3002	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	10313	NOK	0.0222	
3247	OCTA-CDD	458/460 (87/100)	458+460	2.044	30048		0.104	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: DATE: 3/21/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/10/88 REVIEWED: DATE: 3/21/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/10/88 REVIEWED:__________ DATE:________

GF102832

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X4
SAMPLE ID: 1028-1032 (MMS OUTLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS .

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1830	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1665950	NA	2.35	NA
2756	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2443070	NA	4.90	NA.
1760	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	784144	0.572		47.7
2265	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1318680	1.223		49.9
2645	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2018420	2.735		55.2
2918	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1258290	2.495		51.4
1857	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	549552	0.573		45.8
2392	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	645484	1.171		47.2
2730	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1208270	2.577		52.6
3001	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	763478	2.456		50.1
3246	13C-OCDD	470/472 (87/100)	472	0.605	1790310	5.939		48.3
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	6304596		3.72	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	3631907		2.97	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	1559869		1.709	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	589004		0.953	
3256	OCTA-CDF	442/444 (87/100)	442+444	2.192	80047		0.251	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	701598		0.674	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	543260		0.716	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	620371		1.082	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	455632		0.963	
3246	OCTA-CDD	458/460 (87/100)	458+460	2.044	314143		1.056	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: Mike Mill DATE: 3/21/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/7/88 REVIEWED: Mike Mill DATE: 3/21/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/7/88 REVIEWED:__________ DATE:________

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PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X4
SAMPLE ID: 1028-1032 (MMS OUTLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,9-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1762	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	853992		0.504	
2259	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	71365		0.0561	
2267	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	240611		0.225	
2351	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	278303		0.228	
2647	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	314694		0.332	
2657	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	176442		0.171	
2667	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	31050	ND<	0.0511	
2710	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	179025		0.196	
2774	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	11058		0.0133	
2920	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	373292		0.604	
3033	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	60309		0.111	
3253	OCTA-CDF	442/444 (87/100)	442+444	2.192	80047		0.251	
1859	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	48427		0.0465	
2394	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	54956		0.0725	
2722	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	31414		0.0690	
2732	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	51465		0.152	
2759	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	68048		0.119	
3003	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	241336		0.510	
3248	OCTA-CDD	458/460 (87/100)	458+460	2.044	314143		1.056	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: Mike Milz DATE: 3/21/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/7/88 REVIEWED: Mike Milz DATE: 3/21/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/7/88 REVIEWED:__________ DATE:__________

DF202032

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X6
SAMPLE ID: 2028-2032 (MM5 OUTLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1830	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	674928	NA	2.35	NA
2755	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	993524	NA	4.90	NA
1760	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	261124	0.470		39.2
2265	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	502868	1.151		47.0
2644	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	827024	2.755		55.7
2916	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	477032	2.326		48.0
1857	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	191745	0.493		39.4
2391	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	242288	1.085		43.7
2729	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	462198	2.424		49.5
2999	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	293332	2.320		47.4
3245	13C-OCDD	470/472 (87/100)	472	0.605	675540	5.511		44.8
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	3175955		5.63	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	2022199		4.34	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	1000619		2.68	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	351868		1.50	
3255	OCTA-CDF	442/444 (87/100)	442+444	2.192	436907		3.63	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	419139		1.15	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	535508		1.88	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	401531		1.83	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	306677		1.69	
3246	OCTA-CDD	458/460 (87/100)	458+460	2.044	185415		1.65	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: DATE: 3/22/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/7/88 REVIEWED: DATE: 3/22/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/7/88 REVIEWED:________ DATE:________

DF202032

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X6
SAMPLE ID: 2028-2032 (MM5 OUTLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 2.35 ng
13C-1,2,3,7,8,9-HxCDD 4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF 1.20 NG
13C-1,2,3,7,8-PeCDF 2.45 NG
13C-1,2,3,4,7,8-HxCDF 4.95 NG
13C-1,2,3,4,6,7,8-HpCDF 4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD 1.25 NG
13C-1,2,3,7,8-PeCDD 2.48 NG
13C-1,2,3,6,7,8-HxCDD 4.90 NG
13C-1,2,3,4,6,7,8-HpCDD 4.90 NG
13C-OCDD 12.3 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1762	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	447576		0.793	
2259	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	45835		0.0929	
2267	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	149378		0.366	
2351	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	155264		0.333	
2646	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	195740		0.503	
2656	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	122002		0.288	
2666	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	9882		0.0348	
2709	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	80015		0.214	
2773	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	10856		0.0318	
2918	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	218315		0.932	
3031	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	40409		0.196	
3252	OCTA-CDF	442/444 (87/100)	442+444	2.192	436907		3.63	
1859	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	63011		0.174	
2393	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	33257		0.117	
2721	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	21328		0.122	
2731	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	34628		0.268	
2758	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	51977		0.237	
3001	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	164390		0.904	
3247	OCTA-CDD	458/460 (87/100)	458+460	2.044	185415		1.65	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: DATE: 3/22/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/7/88 REVIEWED: DATE: 3/22/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/7/88 REVIEWED: ________ DATE: ________

DF302832

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X7
SAMPLE ID: 3028-3032 (MMS OUTLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1831	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	635120	NA	2.35	NA
2756	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	1056440	NA	4.90	NA
1760	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	320812	0.614		51.2
2266	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	554456	1.349		55.0
2645	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	932660	2.922		59.0
2917	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	581961	2.669		55.0
1858	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	268768	0.734		58.8
2392	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	292358	1.391		56.1
2730	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	574976	2.836		57.9
3000	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	351094	2.612		53.3
3245	13C-OCDD	470/472 (87/100)	472	0.605	848414	6.509		52.9
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	1322152		1.91	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	700196		1.36	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	355434		0.843	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	149082		0.521	
3255	OCTA-CDF	442/444 (87/100)	442+444	2.192	19030		0.126	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	116076		0.228	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	100754		0.293	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	130339		0.478	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	110062		0.506	
3246	OCTA-CDD	458/460 (87/100)	458+460	2.044	80725		0.573	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: ______ DATE: 3/2/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/7/88 REVIEWED: ______ DATE: 3/2/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/7/88 REVIEWED: ______ DATE: ______

DF302832

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X7
SAMPLE ID: 3028-3032 (MM5 OUTLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.98 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1762	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	210326		0.303	
2260	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	12850		0.0240	
2268	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	42028		0.0934	
2352	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	60137		0.117	
2647	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	83015		0.189	
2657	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	44379		0.0929	
2667	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	21558	NDK	0.0749	
2710	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	38212		0.0906	
2774	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	8540	NDK	0.0222	
2919	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	92841		0.325	
3032	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	17720		0.0705	
3252	OCTA-CDF	442/444 (87/100)	442+444	2.192	19030		0.126	
1860	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	11556	NDK	0.0227	
2394	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	16881		0.0491	
2722	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	10237		0.0472	
2732	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	14079		0.0874	
2759	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	20119		0.0738	
3002	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	58609		0.269	
3247	OCTA-CDD	458/460 (87/100)	458+460	2.044	80726		0.573	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: ______ DATE: 3/7/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/7/88 REVIEWED: ______ DATE: 3/21/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/7/88 REVIEWED: ______ DATE: ______

G.3 Notebook Pages - Extraction

EXTRACTION OF AIR PARTICULATE FILTERS/PROBE RINSE RESIDUES

P[illegible]T: 8910L0214

DATE: 1/4/88

	Glassware Identification					Method Internal Standard			
Sample No.	R-B Flask	Soxhlet	Condensor	Solvent	Lot	Std No.	Vol.(uL)	Analyte	Amount
1013 (filter), 1011, 1012	115	5	5	Toluene	ARS18				
2011-2013	201	1	1	↓	↓				
3011-3013	112	2	2	↓	↓				

EXTRACTION STARTED: 4:30p 1/4/88 EXTRACTION STOPPED: 10:30a 1/5/88

7.1.1 Extraction of Air Particulate Filters/Probe Rinse Residues

The air particulate filters will be Soxhlet extracted with methylene chloride, benzene or hexane as required by the project contract.

7.1.1.1 Set up a § 55/50 Soxhlet extraction apparatus with 200 mL of the appropriate solvent in a 500-mL round-bottom flask along with several Berl saddle boiling chips or silicon carbide boiling chips. Record identification numbers of glassware and lot numbers of solvent in lab record book (LRB). Collect the glassware rinses and archive.

7.1.1.2 Put preextracted regular glass wool in the bottom of the soxhlet extractor to prevent particulates from entering the soxhlet arm. Carefully fold filter in half. Do not allow any particulate material to be lost from the filter.

7.1.1.3 Add the sample to the Soxhlet extractor with tweezers being careful not to allow any particulate material to be lost from the filter. Rinse the sample container with three 5-mL portions of extraction solvent.

7.1.1.4 Spike the sample with 50 µL of the method internal standard (surrogate) compound solution.

7.1.1.5 Soxhlet extract the filter/probe rinse residue sample for at least 16 hr.

7.1.1.6 Drain the solvent extract back into the receiving flask and save for combining with the XAD-2 resin extracts and probe rinses as required by the project contract.

Reference: SOP's for the Analysis of Incineration Samples for Volatile and Semivolatile Principal Organic Hazardous Constituents (Draft: October 1986)

CHEMISTS: Prep: K. Addison
Ext:
Ext:
MIS:

Validated by/Date:

Reviewed by/Date: Marilyn Whitacre 1/22/88

COMMENTS or MODIFICATIONS TO PROTOCOL:

Allowed to extract for 18 hrs because of long cylce time of toluene

ECT 8910L0214

EXTRACTION OF ~~AIR PARTICULATE FILTERS/PROBE RINSE RESIDUES~~ ASH

DATE: 1/21/88

Sample No.	Glassware Identification R-B Flask	Soxhlet	Condensor	Solvent	Lot	wt. of sample ~~Std No~~	Method Internal Standard Vol.(uL)	Analyte	Amount
1035	106	6	6	Toluene	AQ458	20.0g			
2035	205	5	5						
3035A	111	1	1						
3035B	207	2	2						
☆ 1038	103	3	3						
2038	104	4	4						
Method Blank	109	9	9			glasswool only			

EXTRACTION STARTED:

EXTRACTION STOPPED:

7.1.1 Extraction of Air Particulate Filters/Probe Rinse Residues

The air particulate filters will be Soxhlet extracted with methylene chloride, benzene or hexane as required by the project contract.

7.1.1.1 Set up a $ 55/50 Soxhlet extraction apparatus with 200 ml of the appropriate solvent in a 500-mL round-bottom flask along with several Berl saddle boiling chips or silicon carbide boiling chips. Record identification numbers of glassware and lot numbers of solvent in lab record book (LRB). Collect the glassware rinses and archive.

7.1.1.2 Put preextracted regular glass wool in the bottom of the soxhlet extractor to prevent particulates from entering the soxhlet arm. Carefully fold filter in half. Do not allow any particulate material to be lost from the filter.

7.1.1.3 Add the sample to the Soxhlet extractor with tweezers being careful not to allow any particulate material to be lost from the filter. Rinse the sample container with three 5-mL portions of extraction solvent.

7.1.1.4 Spike the sample with 30 µL of the method internal standard (surrogate) compound solution.

7.1.1.5 Soxhlet extract the filter/probe rinse residue sample for at least 16 hr.

7.1.1.6 Drain the solvent extract back into the receiving flask and save for combining with the XAD-2 resin extracts and probe rinses as required by the project contract.

Reference: SOP's for the Analysis of Incineration Samples for Volatile and Semivolatile Principal Organic Hazardous Constituents (Draft; October 1986)

CHEMISTS: Prep: K. Addison
Ext: ____
Ext: ____
MIS: ____

Validated by/Date: ____

Reviewed by/Date: M. Whitacre 1-22-88

☆ **COMMENTS or MODIFICATIONS TO PROTOCOL:**
#3 soxhlet doesn't cycle. Had to transfer contents to #13.

ECN ______ 89101-0214

EXTRACTION OF ~~AIR PARTICULATE FILTERS/PROBE RINSE RESIDUES~~ ASH

DATE: 1/11/88

Sample No.	Glassware Identification R-B Flask	 Soxhlet	 Condensor	Solvent	Lot	sample wt Method Internal Standard ~~Std No.~~	 Vol.(uL)	Analyte	Amount
3038-A	106	6	6	Toluene	AQ158	20.0g			
3038-B	205	15	5						
2044-A	111	11	1						
2044-B	207	12	2						
1044 ~~2044-B~~	109	10	3			↓			
method Blank	104	14	4.	↓	↓	glassware only			

EXTRACTION STARTED: 4:00 p.m. 1/11/88 **EXTRACTION STOPPED:** 10:00a.m. 1/12/88

7.1.1 Extraction of Air Particulate Filters/Probe Rinse Residues

The air particulate filters will be Soxhlet extracted with methylene chloride, benzene or hexane as required by the project contract.

7.1.1.1 Set up a $ 55/50 Soxhlet extraction apparatus with 200 mL of the appropriate solvent in a 500-mL round-bottom flask along with several Berl saddle boiling chips or silicon carbide boiling chips. Record identification numbers of glassware and lot numbers of solvent in lab record book (LRB). Collect the glassware rinses and archive.

7.1.1.2 Put preextracted regular glass wool in the bottom of the soxhlet extractor to prevent particulates from entering the soxhlet arm. Carefully fold filter in half. Do not allow any particulate material to be lost from the filter.

7.1.1.3 Add the sample to the Soxhlet extractor with tweezers being careful not to allow any particulate material to be lost from the filter. Rinse the sample container with three 5-mL portions of extraction solvent.

7.1.1.4 Spike the sample with 50 µL of the method internal standard (surrogate) compound solution.

7.1.1.5 Soxhlet extract the filter/probe rinse residue sample for at least 16 hr.

7.1.1.6 Drain the solvent extract back into the receiving flask and save for combining with the XAD-2 resin extracts and probe rinses as required by the project contract.

Reference: SOP's for the Analysis of Incineration Samples for Volatile and Semivolatile Principal Organic Hazardous Constituents (Draft: October 1986)

CHEMISTS: Prep: Kelly Addison

Ext: ______

Ext: ______

MIS: ______

Validated by/Date: ______

Reviewed by/Date: M.Wallace 1-22-88

COMMENTS or MODIFICATIONS TO PROTOCOL:

20.0g of all samples except #1044 was weighed into ~~#1044~~ jars and covered with solvent on ~~1/10/88~~ 1/8/88. #1044 was put into closed jars and allowed to "dry" over the weekend. When weighed out on 1/11/88, it was not as dry as #2044, but it had dryed out somewhat.

Also, it was very difficult to transfer the wet ash + solvent to the soxhlet. Some of the sample 21.30 wouldn't come out of jar (very small amount) and some went down the side arm.

JEC 8710L02 #4

EXTRACTION OF XAD-2 RESIN

DATE: 1/4/88

	Glassware Identification					Method Internal Standard			
Sample No.	R-B Flask	Soxhlet	Condensor	Solvent	Lot	Std No.	Vol.(uL)	Analyte	Amount
1015	101	1	1	Toluene	AR518				
2015	102	2	2						
3015	~~103~~ 13	3	3						
QA 4512 fbk	104	4	4						
QA 4513 Blk	105	5	5						

EXTRACTION STARTED: 4:30 P 1/4/88 EXTRACTION STOPPED: 10:30 A 1/5/88

7.1.2 Extraction of XAD-2 Resin

The MM5 sampling train contains an XAD-2 resin trap containing ~ 75 g of XAD-2 resin. This trap may be extremely wet because stack gas condensate passes through it during sampling.

7.1.2.1 Set up a Ŧ 71/60 Soxhlet extractor with a Ŧ 29/42 joint attached to a 1,000-mL round-bottom flask containing 600 mL of the appropriate solvent and several Berl saddle boiling chips or silicon carbide boiling chips. Record the identification numbers of the glassware and the lot numbers of the solvent in the LRB and collect the glassware rinses and archive.

7.1.2.2 Add the ~ 75 g of XAD-2 resin from each collection trap to the Soxhlet extractor. Use pre-extracted regular glass wool to hold the XAD-2 resin in the Soxhlet extractor. Soxhlet extractors should not be filled more than one-half full with resin.

7.1.2.3 Spike the XAD-2 resin with 50 µL of the appropriate method internal standard (surrogate) solution.

7.1.2.4 Soxhlet extract the resin for at least 16 hr.

7.1.2.5 If the methylene chloride extract in the round-bottom flask develops an aqueous layer on top of the methylene chloride layer, remove the water using a 2,000-mL separatory funnel.

7.1.2.6 Drain the solvent extract back into the round-bottom flask and save for combining with the condensate water and filter extracts as required by the project contract.

Reference: SOP's for the Analysis of Incineration Samples for Volatile and Semivolatile Principal Organic Hazardous Constituents (In eff. October 1986)

CHEMISTS: Prep: P Perkins
Ext:
Ext:
MIS:

Validated by/Date:

Reviewed by/Date: M Whitacre 1-22

COMMENTS or MODIFICATIONS TO PROTOCOL:

JEC 891020244

EXTRACTION OF XAD-2 RESIN + filters

DATE: 1/15/88

Sample No.	Glassware Identification K-D Flask	Soxhlet	Condenser	Solvent	Lot	Method Internal Standard Std No.	Vol.(uL)	Analyte	Amount
1028, 1031	301	7	1	Toluene	AR518				
2028, 2031	302	8	2						
3028, 3031	303	9	3						
13012, 13015	304	10	4						
15012, 15015	305	11	5						
18012, 18015	107	12	6						
4518 QA spike - XAD/filter	108	14	7						
4519 QA Blank - XAD/filter	208	8	5						

EXTRACTION STARTED: 4:30 p 1/15/88 medium Soxhlet **EXTRACTION STOPPED:** 10:30 A 1/21/88

7.1.2 Extraction of XAD-2 Resin

The MM5 sampling train contains an XAD-2 resin trap containing ~ 75 g of XAD-2 resin. This trap may be extremely wet because stack gas condensate passes through it during sampling.

7.1.2.1 Set up a ₮ 71/60 Soxhlet extractor with a ₮ 29/42 joint attached to a 1,000-mL round-bottom flask containing 500 mL of the appropriate solvent and several Berl saddle boiling chips or silicon carbide boiling chips. Record the identification numbers of the glassware and the lot numbers of the solvent in the LAB and collect the glassware rinses and archive.

7.1.2.2 Add the ~ 75 g of XAD-2 resin from each collection trap to the Soxhlet extractor. Use pre-extracted regular glass wool to hold the XAD-2 resin in the Soxhlet extractor. Soxhlet extractors should not be filled more than one-half full with resin.

7.1.2.3 Spike the XAD-2 resin with 50 µL of the appropriate method internal standard (surrogate) solution.

7.1.2.4 Soxhlet extract the resin for at least 16 hr.

7.1.2.5 If the methylene chloride extract in the round-bottom flask develops an aqueous layer on top of the methylene chloride layer, remove the water using a 2,000-mL separatory funnel.

7.1.2.6 Drain the solvent extract back into the round-bottom flask and save for combining with the condensate water and filter extracts as required by the project contract.

Reference: SOP's for the Analysis of Incineration Samples for Volatile and Semivolatile Principal Organic Hazardous Constituents (Draft, October 1986)

CHEMISTS: Prep: K Addison
Ext: ____
Ext: ____
MIS: ____

Validated by/Date: ____

Reviewed by/Date: M Whitacre 1-22-88

COMMENTS or MODIFICATIONS TO PROTOCOL:

#8 med Soxhlet - continuously cycled, never actually "dumped"

#1029, 2029, 3029 (front½ rinses) were not filtered

JEO 8910LB244

EXTRACTION OF XAD-2 RESIN

DATE: 1/5/88

Sample No.	Glassware Identification R-B Flask	Soxhlet	Condensor	Solvent	Lot	Method Internal Standard Std No.	Vol.(uL)	Analyte	Amount
★ F-130	203	3	3	Toluene	AR518				
F-145	~~204~~ 104	4	4	↓	↓				
F-176	109	9	9						
~~1016~~ 4516 QA Filter Spike	206	6	5						
~~1017~~ 4517 QA Filter Blank	107	7	2						
~~QA~~ XAD water									

EXTRACTION STARTED: 4:30P 1/5/88 EXTRACTION STOPPED: 10:30A 1/6/88

7.1.2 Extraction of XAD-2 Resin

The MM5 sampling train contains an XAD-2 resin trap containing ~ 75 g of XAD-2 resin. This trap may be extremely wet because stack gas condensate passes through it during sampling.

7.1.2.1 Set up a ₮ 71/60 Soxhlet extractor with a ₮ 29/42 joint attached to a 1,000-mL round-bottom flask containing 600 mL of the appropriate solvent and several Berl saddle boiling chips or silicon carbide boiling chips. Record the identification numbers of the glassware and the lot numbers of the solvent in the LRB and collect the glassware rinses and archive.

7.1.2.2 Add the ~ 75 g of XAD-2 resin from each collection trap to the Soxhlet extractor. Use pre-extracted regular glass wool to hold the XAD-2 resin in the Soxhlet extractor. Soxhlet extractors should not be filled more than one-half full with resin.

7.1.2.3 Spike the XAD-2 resin with 50 μL of the appropriate method internal standard (surrogate) solution.

7.1.2.4 Soxhlet extract the resin for at least 16 hr.

7.1.2.5 If the methylene chloride extract in the round-bottom flask develops an aqueous layer on top of the methylene chloride layer, remove the water using a 2,000-mL separatory funnel.

7.1.2.6 Drain the solvent extract back into the round-bottom flask and save for combining with the condensate water and filter extracts as required by the project contract.

References: SOP's for the Analysis of Incineration Samples for Volatile and Semivolatile Principal Organic Hazardous Constituents [illegible]

CHEMISTS: Prep: K. Addison
Ext:
Ext:
MIS:

Validated by/Date:

Reviewed by/Date: M. Whitacre 1-22-88

COMMENTS or MODIFICATIONS TO PROTOCOL:

★ EPA Audit samples ~~#130~~

#130 155.3g
115.8g
39.5g

#145 sample + solvent 425.1 (in Soxhlet + glass)
333.7 (soxhlet + glassware)
91.4g ← This number represents wt. of sample + solvent. Current weighed before extraction. Wt. can be obtained by drying XAD of this wt. as needed

#176 156.1g
116.6g
39.5g

This sample was in a soxhlet (#9) that filled completely to the top of the cycle arm but never dumped, just had a steady drip of solvent into RB.

SEPARATORY FUNNEL EXTRACTION

[illegible] 891DL0024

DATE: 1/5/88 & 1/6

SAMPLE NO.	GLASSWARE ID SEP.FUNNEL	GLASSWARE ID KD FLASK	INIT. pH	ADJ. pH	EXT. SOLVENT	LOT	Method Internal Standard Std No.	Method Internal Standard Vol.(uL)	Analyte	Amount
	2000ml					1/5				
1013	1		0	7	MeCl2	AR534				
2013	2		0	7						
1014 & 1016	3		0	7						
QA 08514	4 water spike		7	none						
QA 08515	6 water blank		7	none		1/6				
3014 & 3016	8		0	7						
2014 & 2016	9		1	8						
7 1031,1032	1									

COMMENTS or MODIFICATIONS TO PROTOCOL:

Additional MeCl2 lot # AQ115 used w/ 2014 & 2016;

CHEMISTS: Prep: L. Perkins
Ext:
Ext:
MIS:

Validated by/Date:

Reviewed by/Date: M. Whitacre 1-22-88

7.1.3.2 Separatory funnel extraction (EPA Method 625)

This method is designed to quantitatively extract semivolatile organic compounds from liquid samples using standard separatory funnel techniques. If emulsions prevent acceptable recovery with the separatory funnel, continuous extraction (Section 7.1.3.3) may be used.

7.1.3.2.1 The liquid sample is extracted in a 2000 mL separatory funnel. Record the glassware identification numbers in the LAB and collect the appropriate glassware rinse and archive.

7.1.3.2.2 Add the sample to the separatory funnel. If there are two liquid phases, drain the water phase back into the sample container. Drain the organic layer through a fluted glass funnel containing a small plug of pre-extracted silanized glass wool and 1/3 full of pre-extracted anhydrous Na_2SO_4 into a 500 mL K-D flask and follow the procedures outlined in Section 8.0.

7.1.3.2.3 Mark the water meniscus on the side of the sample container for determination of sample volume. Pour the aqueous layer back into the separatory funnel, spike with method internal standard solution, and gently swirl the solution.

7.1.3.2.4 The pH of the aqueous sample is checked using a glass stirring rod and multi-range pH paper.

7.1.3.2.5 Adjust the pH to about 7 using 6 N sodium hydroxide for acidic samples or 6 N sulfuric acid for alkaline samples. Add acid or base, swirl contents of separatory funnel, check pH, and repeat as necessary until a neutral pH is attained. However, if any acidic POHCs are known to be in the sample, adjust the pH to 2-3 and if any basic POHCs are known to be in the sample, adjust the pH to 11-12 prior to extraction.

7.1.3.2.6 Add 60 mL of methylene chloride to the sample bottle, cap and shake 30 sec to rinse the walls.

7.1.3.2.7 Transfer the methylene chloride to the separatory funnel and extract the sample by vigorously shaking the funnel for 2 min with periodic venting to release excess vapor pressure. Record lot number of solvent in LAB.

7.1.3.2.8 Allow the organic layer to separate from the water phase. Drain the methylene chloride extract through the funnel of sodium sulfate into the K-D flask.

7.1.3.2.9 Repeat the extraction procedure (7.1.3.1.6-7.1.3.1.8) two more times. Combine the three fractions and follow the procedures outlined in Section 8.0.

7.1.3.2.10 At least one spike, which consists of 1,000 mL of Milli-Q water spiked with the method internal standard and extracted in the same manner as the sample, is run for each project or project phase where a sample is analyzed.

SEPARATORY FUNNEL EXTRACTION

FIL F NO. 8910L0244

DATE: 1/6/88

SAMPLE NO.	GLASSWARE ID SEP. FUNNEL	GLASSWARE ID KD FLASK	INIT. pH	ADJ. pH	EXT. SOLVENT	LOT	Method Internal Standard Std No.	Method Internal Standard Vol.(ul.)	Analyte	Amount
Blank Train MIF 3013, ~~15~~ 13014, 13016	2				MeCl2	AK534				
Blank Train 5013, 15014, 15016	3				↓	↓				
Blank Train 2013, 18014, 18016	4				↓	↓				
3029, 2032, 2032	12				↓	↓				
3029, 3030, 3032	6				↓	↓				

COMMENTS or MODIFICATIONS TO PROTOCOL:
Additional MeCl2 lot # AQ115 used w/ (2029, 2030, 2032), (13013, 13014, 13016) + (18013, 18014 + 18016)

CHEMISTS: Prep:
Ext:
Ext:
MIS:

7.1.3.2 Separatory funnel extraction (EPA Method 625)

This method is designed to quantitatively extract semivolatile organic compounds from liquid samples using standard separatory funnel techniques. If emulsions prevent acceptable recovery with the separatory funnel, continuous extraction (Section 7.1.3.3) may be used.

7.1.3.2.1 The liquid sample is extracted in a 2000 mL separatory funnel. Record the glassware identification numbers in the LRB and collect the appropriate glassware rinse and archive.

7.1.3.2.2 Add the sample to the separatory funnel. If there are two liquid phases, drain the water phase back into the sample container. Drain the organic layer through a fluted glass funnel containing a small plug of pre-extracted silanized glass wool and 1/3 full of pre-extracted anhydrous Na_2SO_4 into a 500 mL K-D flask and follow the procedures outlined in Section 8.0.

7.1.3.2.3 Mark the water meniscus on the side of the sample container for determination of sample volume. Pour the aqueous layer back into the separatory funnel, spike with method internal standard solution, and gently swirl the solution.

7.1.3.2.4 The pH of the aqueous sample is checked using a glass stirring rod and multi-range pH paper.

7.1.3.2.5 Adjust the pH to about 7 using 6 N sodium hydroxide for acidic samples or 6 N sulfuric acid for alkaline samples. Add acid or base, swirl contents of separatory funnel, check pH, and repeat as necessary until a neutral pH is attained. However, if any acidic POHCs are known to be in the sample, adjust the pH to 2-3 and if any basic POHCs are known to be in the sample, adjust the pH to 11-12 prior to extraction.

7.1.3.2.6 Add 60 mL of methylene chloride to the sample bottle, cap and shake 30 sec to rinse the walls.

7.1.3.2.7 Transfer the methylene chloride to the separatory funnel and extract the sample by vigorously shaking the funnel for 2 min with periodic venting to release excess vapor pressure. Record lot number of solvent in LRB.

7.1.3.2.8 Allow the organic layer to separate from the water phase. Drain the methylene chloride extract through the funnel of sodium sulfate into the K-D flask.

7.1.3.2.9 Repeat the extraction procedure (7.1.3.1.6-7.1.3.1.8) two more times. Combine the three fractions and follow the procedures outlined in Section 8.0.

7.1.3.2.10 At least one spike, which consists of 1,000 mL of Milli-Q water spiked with the method internal standard and extracted in the same manner as the sample, is run for each project or project phase where a sample is analyzed.

Validated by/Date:

Reviewed by/Date:
M. Whitacre 1-22-88

SEPARATORY FUNNEL EXTRACTION

[illegible] NO: ____________________

DATE: ____________________

SAMPLE NO.	GLASSWARE ID SEP. FUNNEL	 KD FLASK	INIT. pH	ADJ. pH	EXT. SOLVENT LOT	Method Internal Standard Std No.	 Vol.(uL)	 Analyte	 Amount

COMMENTS or MODIFICATIONS TO PROTOCOL:

CHEMISTS: Prop: ____________

Ext: ____________

Ext: ____________

MIS: ____________

Validated by/Date:

Reviewed by/Date:

7.1.3.2 Separatory funnel extraction (EPA Method 625)

This method is designed to quantitatively extract semivolatile organic compounds from liquid samples using standard separatory funnel techniques. If emulsions prevent acceptable recovery with the separatory funnel, continuous extraction (Section 7.1.3.3) may be used.

7.1.3.2.1 The liquid sample is extracted in a 2000 mL separatory funnel. Record the glassware identification numbers in the LRB and collect the appropriate glassware rinse and archive.

7.1.3.2.2 Add the sample to the separatory funnel. If there are two liquid phases, drain the water phase back into the sample container. Drain the organic layer through a fluted glass funnel containing a small plug of pre-extracted silanized glass wool and 1/3 full of pre-extracted anhydrous Na_2SO_4 into a 500 mL K-D flask and follow the procedures outlined in Section 8.0.

7.1.3.2.3 Mark the water meniscus on the side of the sample container for determination of sample volume. Pour the aqueous layer back into the separatory funnel, spike with method internal standard solution, and gently swirl the solution.

7.1.3.2.4 The pH of the aqueous sample is checked using a glass stirring rod and multi-range pH paper.

7.1.3.2.5 Adjust the pH to about 7 using 6 N sodium hydroxide for acidic samples or 6 N sulfuric acid for alkaline samples. Add acid or base, swirl contents of separatory funnel, check pH, and repeat as necessary until a neutral pH is attained. However, if any acidic POHCs are known to be in the sample, adjust the pH to 2-3 and if any basic POHCs are known to be in the sample, adjust the pH to 11-12 prior to extraction.

7.1.3.2.6 Add 60 mL of methylene chloride to the sample bottle, cap and shake 30 sec to rinse the walls.

7.1.3.2.7 Transfer the methylene chloride to the separatory funnel and extract the sample by vigorously shaking the funnel for 2 min with periodic venting to release excess vapor pressure. Record lot number of solvent in LRB.

7.1.3.2.8 Allow the organic layer to separate from the water phase. Drain the methylene chloride extract through the funnel of sodium sulfate into the K-D flask.

7.1.3.2.9 Repeat the extraction procedure (7.1.3.1.6-7.1.3.1.8) two more times. Combine the three fractions and follow the procedures outlined in Section 8.0.

7.1.3.2.10 At least one spike, which consists of 1,900 mL of Milli-Q water spiked with the method internal standard and extracted in the same manner as the sample, is run for each project or project phase where a sample is analyzed.

~~K-D~~ CONCENTRATION OF EXTRACTED SAMPLES

Rotovap

PROJECT NO.: 8101-054
DATE: 1/7/88 & 1/8/88

SAMPLE NO.	Rotovap ~~K-D~~ FLASK ID.	CONTAINER RINSE SOLVENT	CONTAINER RINSE LOT NO.	HEXANE LOT NO.	(OPTION C ONLY) PCDD/F FRACTION ID	(OPTION C ONLY) PCB FRACTION ID
1/7/88 1011-1013	8/204	Toluene	AK 518			
2011-2013	13/113					
3011-3013	9/209					
QC Spike 4516	14/114					
QC Blank 4517	1/208					
1/8/88 2014-2016	2/203					
1014-1016	3/203					

CHEMISTS:

Reviewed by/date:
M. Whitacre 1-22-88

ANALYSIS OPTION: A (PCBs) [✓ B (PCDD/PCDFs)] C (PCBs & PCDD/Fs)
(circle one)

COMMENTS or MODIFICATIONS TO PROTOCOL:
Sample 2011-2013 very cloudy when front ½ rinse was filtered through Na_2SO_4. Sample 3011-3013 contained H_2O which clogged Na_2SO_4 when front ½ rinse was filtered. Na_2SO_4 was rinsed as much as possible & new Na_2SO_4 was used before rest was filtered. H_2O was introduced into sample when acetone was used to rinse Na_2SO_4. The water was not discovered until rotovaping was done therefore all solvent was completely evaporated.

8.1 K-D Concentration of Extracted Samples

AP 3/22

8.1.1 ~~Place a small plug of pre-extracted silanized glass wool in a fluted glass funnel and fill approximately 1/3 full with pre-extracted anhydrous sodium sulfate.~~ Rotary evaporation according to S.O.P.

8.1.2 Transfer sample extract from original extract container via the funnel to a 500-mL K-D flask equipped with a 10-25 mL graduated concentrator tube containing two clean boiling chips (crushed Berl Saddles). Make sure receiver is tightly in place (with clamp) in order to avoid losing sample or allowing steam to condense in sample. Pour in enough sample extract to fill K-D flask approximately 1/3 to 1/2 full.

Since the volume of sample extract from the extraction procedures will usually be more than a 500-mL K-D flask can hold at one time, several transfers of the sample from the extract container to the K-D flask may be necessary.

8.1.3 Attach a three-ball Snyder column to the K-D flask and wet down with about 1 mL of the appropriate solvent.

8.1.4 Place the K-D apparatus on a steam bath so that the concentrator tube is partially immersed in the water and the entire lower rounded surface of the flask is bathed with steam. Adjust the vertical position of the apparatus as required to sustain a steady rate of evaporation. It may be necessary to wrap foil around the glassware to bring the sample to boiling. At the proper rate of distillation, the balls of the Snyder column will constantly chatter but the chambers will not flood with condensed solvent.

8.1.5 When all of the contents of the original extract container have been added to the K-D flask the container is rinsed (3x) with the appropriate solvent, and the rinses are added to the K-D flask via the funnel.

8.1.6 Concentrate the sample extract to a 5-10 mL volume.

8.1.6.1 Option A: Analysis for PCBs (Figures 2 and 3)

8.1.6.1.1 When 5 to 10 mL of solvent remain, add 40 mL hexane (record lot number in LRB) and two new crushed Berl Saddle boiling chips. Return to steam bath.

8.1.6.1.2 Concentrate the sample extract to near, but not complete, dryness. The extract must be watched very carefully at this point.

8.1.6.1.3 Remove K-D apparatus from the steam bath and allow the solvent to drain. Rinse the K-D apparatus (special attention to ground glass joints) with 5-10 mL of hexane using a 10 mL syringe.

8.1.6.1.4 Concentrate the sample under a gentle N_2 stream to a volume of approximately 1 mL. See Section 8.2: N_2 Concentration of Sample Extracts.

8.1.6.2 Option B: Analysis for PCDD/PCDFs (Figures 4 and 5)

8.1.6.2.1 Follow steps 8.1.6.1.1 - 8.1.6.1.4.

8.1.6.3 Option C: Analysis for both PCBs and PCDD/PCDFs (Figures 6 and 7)

8.1.6.3.1 Follow steps 8.1.6.1.1 - 8.1.6.1.3.

8.1.6.3.2 Bring the volume of the concentrated sample extract to 20 mL by either adding hexane or concentrating under N_2 stream, whichever is necessary.

8.1.6.3.3 Divide the sample for the two different fractions by transferring a 10.0 mL aliquot (using a disposable Class A 10 mL graduated pipet) of the sample to a hexane-rinsed, pre-marked (1 mL) four dram vial for PCDD/PCDF analysis. Concentrate the sample under a gentle N_2 stream to a volume of approximately 1 mL. See Section 8.2: N_2 Concentrations of Sample Extracts.

8.1.6.3.4 The pipet is rinsed with hexane back into the remaining sample extract for PCB analysis. Concentrate the sample extract for PCB analysis under a gentle N_2 stream to a volume of approximately 1 mL. See Section 8.2: N_2 Concentration of Sample Extracts.

~~K-D~~ CONCENTRATION OF EXTRACTED SAMPLES

Rotovap

PROJECT NO.: 8910LD24
DATE: 1/8/88

SAMPLE NO.	K-D FLASK ID.	CONTAINER RINSE SOLVENT	CONTAINER RINSE LOT NO.	HEXANE LOT NO.	(OPTION C ONLY) PCDD/F FRACTION ID	(OPTION C ONLY) PCB FRACTION ID
QA04514	202/2/12/212	MeCl₂	AQ115			
QA04515	104/14/10/4	↓	↓			
1014-1016	3/203	Toluene MeCl₂	AR518 AQ115			
2014-2016	2/203	↓	↓			
3014-3016	7/107	↓	↓			
1028-1032	9/112	↓	↓			

CHEMISTS: K. Addison

Reviewed by/date:
M. Whitacre 1-22-88

ANALYSIS OPTION: A (PCBs) [✓ B (PCDD/PCDFs)] C (PCBs & PCDD/Fs)
(circle one)

COMMENTS or MODIFICATIONS TO PROTOCOL:
#1015 blown to almost dryness.
#3015 had ~50 ml H₂O which was absorbed by Na₂SO₄ poured into round bottom.

8.1 K-D Concentration of Extracted Samples

8.1.1 ~~Place a small plug of pre-extracted silanized glass wool in a fluted glass funnel and fill approximately 1/3 full with pre-extracted anhydrous sodium sulfate.~~ Rotary evaporation according to S.O.P.

8.1.2 Transfer sample extract from original extract container via the funnel to a 500-mL K-D flask equipped with a 10-25 mL graduated concentrator tube containing two clean boiling chips (crushed Berl Saddles). Make sure receiver is tightly in place (with clamp) in order to avoid losing sample or allowing steam to condense in sample. Pour in enough sample extract to fill K-D flask approximately 1/3 to 1/2 full.

Since the volume of sample extract from the extraction procedures will usually be more than a 500-mL K-D flask can hold at one time, several transfers of the sample from the extract container to the K-D flask may be necessary.

8.1.3 Attach a three-ball Snyder column to the K-D flask and wet down with about 1 mL of the appropriate solvent.

8.1.4 Place the K-D apparatus on a steam bath so that the concentrator tube is partially immersed in the water and the entire lower rounded surface of the flask is bathed with steam. Adjust the vertical position of the apparatus as required to sustain a steady rate of evaporation. It may be necessary to wrap foil around the glassware to bring the sample to boiling. At the proper rate of distillation, the balls of the Snyder column will constantly chatter but the chambers will not flood with condensed solvent.

8.1.5 When all of the contents of the original extract container have been added to the K-D flask the container is rinsed (3x) with the appropriate solvent, and the rinses are added to the K-D flask via the funnel.

8.1.6 Concentrate the sample extract to a 5-10 mL volume.

8.1.6.1 Option A: Analysis for PCBs (Figures 2 and 3)

8.1.6.1.1 When 5 to 10 mL of solvent remain, add 40 mL hexane (record lot number in LRB) and two new crushed Berl Saddle boiling chips. Return to steam bath.

8.1.6.1.2 Concentrate the sample extract to near, but not complete, dryness. The extract must be watched very carefully at this point.

8.1.6.1.3 Remove K-D apparatus from the steam bath and allow the solvent to drain. Rinse the K-D apparatus (special attention to ground glass joints) with 5-10 mL of hexane using a 10 mL syringe.

8.1.6.1.4 Concentrate the sample under a gentle N_2 stream to a volume of approximately 1 mL. See Section 8.2: N_2 Concentration of Sample Extracts.

8.1.6.2 Option B: Analysis for PCDD/PCDFs (Figures 4 and 5)

8.1.6.2.1 Follow steps 8.1.6.1.1 - 8.1.6.1.4.

8.1.6.3 Option C: Analysis for both PCBs and PCDD/PCDFs (Figures 6 and 7)

8.1.6.3.1 Follow steps 8.1.6.1.1 - 8.1.6.1.3.

8.1.6.3.2 Bring the volume of the concentrated sample extract to 20 mL by either adding hexane or concentrating under N_2 stream, whichever is necessary.

8.1.6.3.3 Divide the sample for the two different fractions by transferring a 10.0 mL aliquot (using a disposable Class A 10 mL graduated pipet) of the sample to a hexane-rinsed, pre-marked (1 mL) four dram vial for PCDD/PCDF analysis. Concentrate the sample under a gentle N_2 stream to a volume of approximately 1 mL. See Section 8.2: N_2 Concentrations of Sample Extracts.

8.1.6.3.4 The pipet is rinsed with hexane back into the remaining sample extract for PCB analysis. Concentrate the sample extract for PCB analysis under a gentle N_2 stream to a volume of approximately 1 mL. See Section 8.2: N_2 Concentration of Sample Extracts.

~~K-D~~ CONCENTRATION OF EXTRACTED SAMPLES

Rotovap

PROJECT NO.: 8910L0214
DATE: 1/11/88

SAMPLE NO.	K-D FLASK ID.	CONTAINER RINSE SOLVENT	CONTAINER RINSE LOT NO.	HEXANE LOT NO.	(OPTION C ONLY) PCDD/F FRACTION ID	(OPTION C ONLY) PCB FRACTION ID
QA 4513 Blank	113/113	Toluene	AR518			
QA 4512 Spike	115/11					
E-132	11/201					
E-145	8/208					
E-176	14/114					
QA 4519 Blank	14/204					
QA 4518 Spike	12/206					
13013-13016, 13012	1/201					
15013-15016, 15012	7/107					

CHEMISTS: K. Addison
P. Perkins

Reviewed by/date:
M. Whitacre 1-22-88

ANALYSIS OPTION: A (PCBs) [✓ B (PCDD/PCDFs)] C (PCBs & PCDD/Fs)
(circle one)

COMMENTS or MODIFICATIONS TO PROTOCOL:

~~8.1 K-D Concentration of Extracted Samples~~ Rotary evaporation according to SOP. KAA 1/22/88

8.1.1 Place a small plug of pre-extracted silanized glass wool in a fluted glass funnel and fill approximately 1/3 full with pre-extracted anhydrous sodium sulfate.

8.1.2 Transfer sample extract from original extract container via the funnel to a 500-mL K-D flask equipped with a 10-25 mL graduated concentrator tube containing two clean boiling chips (crushed Berl Saddles). Make sure receiver is tightly in place (with clamp) in order to avoid losing sample or allowing steam to condense in sample. Pour in enough sample extract to fill K-D flask approximately 1/3 to 1/2 full.

Since the volume of sample extract from the extraction procedures will usually be more than a 500-mL K-D flask can hold at one time, several transfers of the sample from the extract container to the K-D flask may be necessary.

8.1.3 Attach a three-ball Snyder column to the K-D flask and wet down with about 1 mL of the appropriate solvent.

8.1.4 Place the K-D apparatus on a steam bath so that the concentrator tube is partially immersed in the water and the entire lower rounded surface of the flask is bathed with steam. Adjust the vertical position of the apparatus as required to sustain a steady rate of evaporation. It may be necessary to wrap foil around the glassware to bring the sample to boiling. At the proper rate of distillation, the balls of the Snyder column will constantly chatter but the chambers will not flood with condensed solvent.

8.1.5 When all of the contents of the original extract container have been added to the K-D flask the container is rinsed (3x) with the appropriate solvent, and the rinses are added to the K-D flask via the funnel.

8.1.6 Concentrate the sample extract to a 5-10 mL volume.

8.1.6.1 Option A: Analysis for PCBs (Figures 2 and 3)

8.1.6.1.1 When 5 to 10 mL of solvent remain, add 50 mL hexane (record lot number in LRB) and two new crushed Berl Saddle boiling chips. Return to steam bath.

8.1.6.1.2 Concentrate the sample extract to near, but not complete, dryness. The extract must be watched very carefully at this point.

8.1.6.1.3 Remove K-D apparatus from the steam bath and allow the solvent to drain. Rinse the K-D apparatus (special attention to ground glass joints) with 5-10 mL of hexane using a 10 mL syringe.

8.1.6.1.4 Concentrate the sample under a gentle N_2 stream to a volume of approximately 1 mL. See Section 8.2: N_2 Concentration of Sample Extracts.

8.1.6.2 Option B: Analysis for PCDD/PCDFs (Figures 4 and 5)

8.1.6.2.1 Follow steps 8.1.6.1.1 - 8.1.6.1.4.

8.1.6.3 Option C: Analysis for both PCBs and PCDD/PCDFs (Figures 6 and 7)

8.1.6.3.1 Follow steps 8.1.6.1.1 - 8.1.6.1.3.

8.1.6.3.2 Bring the volume of the concentrated sample extract to 20 mL by either adding hexane or concentrating under N_2 stream, whichever is necessary.

8.1.6.3.3 Divide the sample for the two different fractions by transferring a 10.0 mL aliquot (using a disposable Class A 10 mL graduated pipet) of the sample to a hexane-rinsed, pre-marked (1 mL) four dram vial for PCDD/PCDF analysis. Concentrate the sample under a gentle N_2 stream to a volume of approximately 1 mL. See Section 8.2: N_2 Concentrations of Sample Extracts.

8.1.6.3.4 The pipet is rinsed with hexane back into the remaining sample extract for PCB analysis. Concentrate the sample extract for PCB analysis under a gentle N_2 stream to a volume of approximately 1 mL. See Section 8.2: N_2 Concentration of Sample Extracts.

[illegible]

~~K-D CONCENTRATION~~ OF EXTRACTED SAMPLES

PROJECT NO.: 8910L0214
DATE: 1/12/88

SAMPLE NO.	K-D FLASK ID.	CONTAINER RINSE SOLVENT	CONTAINER RINSE LOT NO.	~~HEXANE~~ LOT NO.	(OPTION C ONLY) PCDD/F FRACTION ID	(OPTION C ONLY) PCB FRACTION ID
18012-18016	14/114	Toluene	AQ458	AR072 ~~A[illegible]~~		
2028-2032	13/103	↓	↓			
3028-3032	8/208	↓	↓			

CHEMISTS: K. Addison
P. Perkins

Reviewed by/date:
M. Whitacre 1-22-88

ANALYSIS OPTION: A (PCBs) [✓ B (PCDD/PCDFs)] C (PCBs & PCDD/Fs)
(circle one)

COMMENTS or MODIFICATIONS TO PROTOCOL:

~~8.1 K-D Concentration of Extracted Samples~~ Rotary Evaporation according to SOP. 1/28/88 KBA

8.1.1 Place a small plug of pre-extracted silanized glass wool in a fluted glass funnel and fill approximately 1/3 full with pre-extracted anhydrous sodium sulfate.

8.1.2 Transfer sample extract from original extract container via the funnel to a 500-mL K-D flask equipped with a 10-25 mL graduated concentrator tube containing two clean boiling chips (crushed Berl Saddles). Make sure receiver is tightly in place (with clamp) in order to avoid losing sample or allowing steam to condense in sample. Pour in enough sample extract to fill K-D flask approximately 1/3 to 1/2 full.

Since the volume of sample extract from the extraction procedures will usually be more than a 500-mL K-D flask can hold at one time, several transfers of the sample from the extract container to the K-D flask may be necessary.

8.1.3 Attach a three-ball Snyder column to the K-D flask and wet down with about 1 mL of the appropriate solvent.

8.1.4 Place the K-D apparatus on a steam bath so that the concentrator tube is partially immersed in the water and the entire lower rounded surface of the flask is bathed with steam. Adjust the vertical position of the apparatus as required to sustain a steady rate of evaporation. It may be necessary to wrap foil around the glassware to bring the sample to boiling. At the proper rate of distillation, the balls of the Snyder column will constantly chatter but the chambers will not flood with condensed solvent.

8.1.5 When all of the contents of the original extract container have been added to the K-D flask the container is rinsed (3x) with the appropriate solvent, and the rinses are added to the K-D flask via the funnel.

8.1.6 Concentrate the sample extract to a 5-10 mL volume.

8.1.6.1 Option A: Analysis for PCBs (Figures 2 and 3)

8.1.6.1.1 When 5 to 10 mL of solvent remain, add 40 mL hexane (record lot number in LRB) and two new crushed Berl Saddle boiling chips. Return to steam bath.

8.1.6.1.2 Concentrate the sample extract to near, but not complete, dryness. The extract must be watched very carefully at [illegible]

8.1.6.1.3 Remove K-D apparatus from the steam bath and allow the solvent to drain. Rinse the K-D apparatus (special attention to ground glass joints) with 5-10 mL of hexane using a 10 mL syringe.

8.1.6.1.4 Concentrate the sample under a gentle N_2 stream to a volume of approximately 1 mL. See Section 8.2: N_2 Concentration of Sample Extracts.

8.1.6.2 Option B: Analysis for PCDD/PCDFs (Figures 4 and 5)

8.1.6.2.1 Follow steps 8.1.6.1.1 - 8.1.6.1.4.

8.1.6.3 Option C: Analysis for both PCBs and PCDD/PCDFs (Figures 6 and 7)

8.1.6.3.1 Follow steps 8.1.6.1.1 - 8.1.6.1.3.

8.1.6.3.2 Bring the volume of the concentrated sample extract to 20 mL by either adding hexane or concentrating under N_2 stream, whichever is necessary.

8.1.6.3.3 Divide the sample for the two different fractions by transferring a 10.0 mL aliquot (using a disposable Class A 10 mL graduated pipet) of the sample to a hexane-rinsed, pre-marked (1 mL) four dram vial for PCDD/PCDF analysis. Concentrate the sample under a gentle N_2 stream to a volume of approximately 1 mL. See Section 8.2: N_2 Concentrations of Sample Extracts.

8.1.6.3.4 The pipet is rinsed with hexane back into the remaining sample extract for PCB analysis. Concentrate the sample extract for PCB analysis under a gentle N_2 stream to a volume of approximately 1 mL. See Section 8.2: N_2 Concentration of Sample Extracts.

COLUMN CLEANUP FOR ANALYSIS OF PCDD/PCDF

PROJECT NO.: 8910C0214
DATE: 1/13/88

SAMPLE NO.	COLUMN NO.	HEXANE (LOT NO. AR072) FRACTION ID	20% METHYLENE CHLORIDE/HEXANE (v/v) (LOT NO. AR588 /LOT NO. AR072) FRACTION ID	50% METHYLENE CHLORIDE/HEXANE (v/v) (LOT NO. AR588 /LOT NO. AR072) FRACTION ID
QA 4512	101/201	65mL	20 mL	20 mL
QA 4513	102/202			
QA 4514	103/203			
QA 4515	104/204			
QA 4516	105/205			
QA 4517	106/206			

COMMENTS or MODIFICATIONS TO PROTOCOL:

8.3.2 Column Cleanup for Analysis of PCDD/PCDF

8.3.2.1 Assemble two columns and take the appropriate glassware rinse.

8.3.2.2 Put a small plug of pre-extracted silanized glass wool in the bottom of each column.

8.3.2.3 Wet-pack one column by filling the column to the bottom of the reservoir bulb with hexane. Pack the column with approximately 6 g of pre-extracted acid alumina followed by an approximate 1 cm layer of pre-extracted Na_2SO_4. Elute and discard enough hexane to bring the solvent level about 1 cm above the Na_2SO_4 layer.

Preelute the acid alumina column with 50 mL of 50% $MeCl_2$/Hexane and collect eluate in a precleaned 4 oz Rx bottle. Archive the preeluate then elute the colum with 100 mL of hexane, discarding the hexane. Leave about 1 cm of hexane above the Na_2SO_4 layer.

8.3.2.4 Wet-pack the other column in the same manner as the column described in 8.3.1.3, eluting and discarding enough hexane to bring solvent level to the top of the acid silica gel layer.

8.3.2.5 Set up the columns such that the silica gel column will elute directly onto the acid alumina column without any splattering or loss of sample.

8.3.2.6 The sample to be applied to the column should be in approximately 1 mL hexane. Apply the sample with a hexane-rinsed pasteur pipet, taking care not to disturb the column packing. Elute enough hexane from the top column to bring the sample level to the top of the column packing. Rinse the sample vial (3x) with 0.6-1 mL hexane and apply to the column. Elute enough hexane to bring the rinse level to the top of the packing.

8.3.2.7 Elute the 2-column setup with 45 mL hexane. To avoid disturbing the column packing, apply approximately 3 mL of the 45 mL hexane with a pasteur pipet, add the rest of the 45 mL and elute the hexane to just above the Na_2SO_4 layer of the bottom column. Collect the eluate in a pre-cleaned 4 oz Rx bottle.

8.3.2.8 Remove the top column and discard in the manner described in 8.3.1.7.

8.3.2.9 Elute the bottom column with 20 mL hexane to just below the Na_2SO_4 layer, collecting the eluate in the same 4 oz Rx bottle from step 8.3.2.7. Mark the solvent level, seal with Teflon-lined cap and Teflon tape and archive.

8.3.2.10 Elute the bottom column with 20 mL of 20% methylene chloride/hexane (v/v) and collect the eluate in a hexane-rinsed 6 dram vial with a Teflon-lined cap. To collect the entire eluate, apply slight back pressure with a pipet bulb. This solvent fraction is to be analyzed for dioxins and furans - mark sample volume, seal with Teflon tape, and refrigerate until sample can be worked up further.

8.3.2.11 Elute the bottom column with 20 mL of 50% methylene chloride/hexane (v/v) and collect the eluate in a hexane-rinsed 6 dram vial with a Teflon-lined cap. Mark the solvent level, seal with Teflon tape, and archive.

8.3.2.12 Dispose of the bottom column in the manner described in 8.3.1.7.

8.3.2.13 Concentrate the 20% $MeCl_2$/hexane fraction under N_2 stream to a 2-3 mL volume. Transfer the sample to a hexane-rinsed reacti-vial using a hexane-rinsed pasteur pipet. Rinse the 6 dram vial (3x) with 1 mL hexane and add the rinses to the sample. Add the appropriate volume of tridecane and concentrate the sample under N_2 stream to the final volume of tridecane.

8.3.1.14 At this point, the sample must be screened for high PCDD/PCDF concentration and/or gross contamination. See Section 9.1 for screening of sample extracts.

8.3.1.15 If the sample is too concentrated, the appropriate calculations will be performed to determine the final concentration of the sample. If the sample is found to be grossly contaminated, then the sample will be subjected to further cleanup procedures; see Section 8.4.

Chemists:
K. Addison
P Peskins

Reviewed by/date:
M. Whitacre 1-22-88

COLUMN CLEANUP FOR ANALYSIS OF PCDD/PCDF

PROJECT NO.: 8910L0214
DATE: 1/13/88

SAMPLE NO.	COLUMN NO.	HEXANE (LOT NO. AR072) FRACTION ID	20% METHYLENE CHLORIDE/HEXANE (v/v) (LOT NO. AR588 /LOT NO. AR072) FRACTION ID	50% METHYLENE CHLORIDE/HEXANE (v/v) (LOT NO. AR588 /LOT NO. AR072) FRACTION ID
QA4518	107/207	65mL	20mL	20mL
QA4519	108/208			
1011-1013	109/209			
2011-2013	110/210			
3011-3013	111/211			
1014-1016	112/212			

COMMENTS or MODIFICATIONS TO PROTOCOL:

Chemists:
K. Addison
P. Perkins

Reviewed by/date:
M.Whitacre 1-22-88

8.3.2 Column Cleanup for Analysis of PCDD/PCDF

8.3.2.1 Assemble two columns and take the appropriate glassware rinse.

8.3.2.2 Put a small plug of pre-extracted silanized glass wool in the bottom of each column.

8.3.2.3 Wet-pack one column by filling the column to the bottom of the reservoir bulb with hexane. Pack the column with approximately 6 g of pre-extracted acid alumina followed by an approximate 1 cm layer of pre-extracted Na_2SO_4. Elute and discard enough hexane to bring the solvent level about 1 cm above the Na_2SO_4 layer.

Preelute the acid alumina column with 50 mL of 50% $MeCl_2$/Hexane and collect eluate in a precleaned 4 oz Rx bottle. Archive the preeluate then elute the colum with 100 mL of hexane, discarding the hexane. Leave about 1 cm of hexane above the Na_2SO_4 layer.

8.3.2.4 Wet-pack the other column in the same manner as the column described in 8.3.1.3, eluting and discarding enough hexane to bring solvent level to the top of the acid silica gel layer.

8.3.2.5 Set up the columns such that the silica gel column will elute directly onto the acid alumina column without any splattering or loss of sample.

8.3.2.6 The sample to be applied to the column should be in approximately 1 mL hexane. Apply the sample with a hexane-rinsed pasteur pipet, taking care not to disturb the column packing. Elute enough hexane from the top column to bring the sample level to the top of the column packing. Rinse the sample vial (3x) with 0.6-1 mL hexane and apply to the column. Elute enough hexane to bring the rinse level to the top of the packing.

8.3.2.7 Elute the 2-column setup with 45 mL hexane. To avoid disturbing the column packing, apply approximately 2 mL of the 45 mL hexane with a pasteur pipet, add the rest of the 45 mL and elute the hexane to just above the Na_2SO_4 layer of the bottom column. Collect the eluate in a pre-cleaned 4 oz Rx bottle.

8.3.2.8 Remove the top column and discard in the manner described in 8.3.1.7.

8.3.2.9 Elute the bottom column with 20 mL hexane to just below the Na_2SO_4 layer, collecting the eluate in the same 4 oz Rx bottle from step 8.3.2.7. Mark the solvent level, seal with Teflon-lined cap and Teflon tape and archive.

8.3.2.10 Elute the bottom column with 20 mL of 20% methylene chloride/hexane (v/v) and collect the eluate in a hexane-rinsed 6 dram vial with a Teflon-lined cap. To collect the entire eluate, apply slight back pressure with a pipet bulb. This solvent fraction is to be analyzed for dioxins and furans - mark sample volume, seal with Teflon tape, and refrigerate until sample can be worked up further.

8.3.2.11 Elute the bottom column with 20 mL of 50% methylene chloride/hexane (v/v) and collect the eluate in a hexane-rinsed 6 dram vial with a Teflon-lined cap. Mark the solvent level, seal with Teflon tape, and archive.

8.3.2.12 Dispose of the bottom column in the manner described in 8.3.1.7.

8.3.2.13 Concentrate the 20% $MeCl_2$/hexane fraction under N_2 stream to a 2-3 mL volume. Transfer the sample to a hexane-rinsed reacti-vial using a hexane-rinsed pasteur pipet. Rinse the 6 dram vial (3x) with 1 mL hexane and add the rinses to the sample. Add the appropriate volume of tridecane and concentrate the sample under N_2 stream to the final volume of tridecane.

8.3.1.14 At this point, the sample must be screened for high PCDD/PCDF concentration and/or gross contamination. See Section 9.1 for screening of sample extracts.

8.3.1.15. If the sample is too concentrated, the appropriate calculations will be performed to determine the final concentration of the sample. If the sample is found to be grossly contaminated, then the sample will be subjected to further cleanup procedures; see Section 8.4.

COLUMN CLEANUP FOR ANALYSIS OF PCDD/PCDF

PROJECT NO.: 8910LQ214
DATE: 1/24/88

SAMPLE NO.	COLUMN NO.	HEXANE (LOT NO. AR072) FRACTION ID	20% METHYLENE CHLORIDE/HEXANE (v/v) (LOT NO AR588 /LOT NO. AR072) FRACTION ID	50% METHYLENE CHLORIDE/HEXANE (v/v) (LOT NO. AR588 /LOT NO. AR072) FRACTION ID
2014-2016	101/201	65mL	20mL	20mL
3014-3016	102/202			
1028-1032	103/203			
2028 - ~~2038~~ 2032 KA	104/204			
3028-3032	105/205			
13012-13016	106/206			

COMMENTS or MODIFICATIONS TO PROTOCOL:

8.3.2 Column Cleanup for Analysis of PCDD/PCDF

8.3.2.1 Assemble two columns and take the appropriate glassware rinse.

8.3.2.2 Put a small plug of pre-extracted silanized glass wool in the bottom of each column.

8.3.2.3 Wet-pack one column by filling the column to the bottom of the reservoir bulb with hexane. Pack the column with approximately 6 g of pre-extracted acid alumina followed by an approximate 1 cm layer of pre-extracted Na_2SO_4. Elute and discard enough hexane to bring the solvent level about 1 cm above the Na_2SO_4 layer.

Preelute the acid alumina column with 50 mL of 50% $MeCl_2$/Hexane and collect eluate in a precleaned 4 oz Rx bottle. Archive the preeluate then elute the colum with 100 mL of hexane, discarding the hexane. Leave about 1 cm of hexane above the Na_2SO_4 layer.

8.3.2.4 Wet-pack the other column in the same manner as the column described in 8.3.1.3, eluting and discarding enough hexane to bring solvent level to the top of the acid silica gel layer.

8.3.2.5 Set up the columns such that the silica gel column will elute directly onto the acid alumina column without any splattering or loss of sample.

8.3.2.6 The sample to be applied to the column should be in approximately 1 mL hexane. Apply the sample with a hexane-rinsed pasteur pipet, taking care not to disturb the column packing. Elute enough hexane from the top column to bring the sample level to the top of the column packing. Rinse the sample vial (3x) with 0.6-1 mL hexane and apply to the column. Elute enough hexane to bring the rinse level to the top of the packing.

8.3.2.7 Elute the 2-column setup with 45 mL hexane. To avoid disturbing the column packing, apply approximately 2 mL of the 45 mL hexane with a pasteur pipet, add the rest of the 45 mL and elute the hexane to just above the Na_2SO_4 layer of the bottom column. Collect the eluate in a pre-cleaned 4 oz Rx bottle.

8.3.2.8 Remove the top column and discard in the manner described in 8.3.1.7.

8.3.2.9 Elute the bottom column with 20 mL hexane to just below the Na_2SO_4 layer, collecting the eluate in the same 4 oz Rx bottle from step 8.3.2.7. Mark the solvent level, seal with Teflon-lined cap and Teflon tape and archive.

8.3.2.10 Elute the bottom column with 20 mL of 20% methylene chloride/hexane (v/v) and collect the eluate in a hexane-rinsed 6 dram vial with a Teflon-lined cap. To collect the entire eluate, apply slight back pressure with a pipet bulb. This solvent fraction is to be analyzed for dioxins and furans - mark sample volume, seal with Teflon tape, and refrigerate until sample can be worked up further.

8.3.2.11 Elute the bottom column with 20 mL of 50% methylene chloride/hexane (v/v) and collect the eluate in a hexane-rinsed 6 dram vial with a Teflon-lined cap. Mark the solvent level, seal with Teflon tape, and archive.

8.3.2.12 Dispose of the bottom column in the manner described in 8.3.1.7.

8.3.2.13 Concentrate the 20% $MeCl_2$/hexane fraction under N_2 stream to a 2-3 mL volume. Transfer the sample to a hexane-rinsed reacti-vial using a hexane-rinsed pasteur pipet. Rinse the 6 dram vial (3x) with 1 mL hexane and add the rinses to the sample. Add the appropriate volume of tridecane and concentrate the sample under N_2 stream to the final volume of tridecane.

8.3.1.14 At this point, the sample must be screened for high PCDD/PCDF concentration and/or gross contamination. See Section 9.1 for screening of sample extracts.

8.3.1.15 If the sample is too concentrated, the appropriate calculations will be performed to determine the final concentration of the sample. If the sample is found to be grossly contaminated, then the sample will be subjected to further cleanup procedures; see Section 8.4.

Chemists:
K. Addison
P. Perkins

Reviewed by/date:
M. Whitacre, 1-22-88

COLUMN CLEANUP FOR ANALYSIS OF PCDD/PCDF

PROJECT NO.: 8910L0214
DATE: 1/14/88

SAMPLE NO.	COLUMN NO.	HEXANE (LOT NO. AR072) FRACTION ID	20% METHYLENE CHLORIDE/HEXANE (v/v) (LOT NO. AR588/LOT NO. AR072) FRACTION ID	50% METHYLENE CHLORIDE/HEXANE (v/v) (LOT NO. AR588 /LOT NO. AR072) FRACTION ID
15012-15016	107/207	65 mL	20 mL	20 mL
18012-18016	108/208	↓	↓	↓
F-130	109/209	↓	↓	↓
F-145	110/210	↓	↓	↓
F-176	111/211	↓	↓	↓

COMMENTS or MODIFICATIONS TO PROTOCOL:

8.3.2 Column Cleanup for Analysis of PCDD/PCDF

8.3.2.1 Assemble two columns and take the appropriate glassware rinse.

8.3.2.2 Put a small plug of pre-extracted silanized glass wool in the bottom of each column.

8.3.2.3 Wet-pack one column by filling the column to the bottom of the reservoir bulb with hexane. Pack the column with approximately 6 g of pre-extracted acid alumina followed by an approximate 1 cm layer of pre-extracted Na_2SO_4. Elute and discard enough hexane to bring the solvent level about 1 cm above the Na_2SO_4 layer.

Preelute the acid alumina column with 50 mL of 50% $MeCl_2$/Hexane and collect eluate in a precleaned 4 oz Rm bottle. Archive the preeluate then elute the colum with 100 mL of hexane, discarding the hexane. Leave about 1 cm of hexane above the Na_2SO_4 layer.

8.3.2.4 Wet-pack the other column in the same manner as the column described in 8.3.1.3, eluting and discarding enough hexane to bring solvent level to the top of the acid silica gel layer.

8.3.2.5 Set up the columns such that the silica gel column will elute directly onto the acid alumina column without any splattering or loss of sample.

8.3.2.6 The sample to be applied to the column should be in approximately 1 mL hexane. Apply the sample with a hexane-rinsed pasteur pipet, taking care not to disturb the column packing. Elute enough hexane from the top column to bring the sample level to the top of the column packing. Rinse the sample vial (3x) with 0.6-1 mL hexane and apply to the column. Elute enough hexane to bring the rinse level to the top of the packing.

8.3.2.7 Elute the 2-column setup with 45 mL hexane. To avoid disturbing the column packing, apply approximately 2 mL of the 45 mL hexane with a pasteur pipet, add the rest of the 45 mL and elute the hexane to just above the Na_2SO_4 layer of the bottom column. Collect the eluate in a pre-cleaned 4 oz Rm bottle.

8.3.2.8 Remove the top column and discard in the manner described in 8.3.1.7.

8.3.2.9 Elute the bottom column with 20 mL hexane to just below the Na_2SO_4 layer, collecting the eluate in the same 4 oz Rx bottle from step 8.3.2.7. Mark the solvent level, seal with Teflon-lined cap and Teflon tape and archive.

8.3.2.10 Elute the bottom column with 20 mL of 20% methylene chloride/hexane (v/v) and collect the eluate in a hexane-rinsed 6 dram vial with a Teflon-lined cap. To collect the entire eluate, apply slight back pressure with a pipet bulb. This solvent fraction is to be analyzed for dioxins and furans - mark sample volume, seal with Teflon tape, and refrigerate until sample can be worked up further.

8.3.2.11 Elute the bottom column with 20 mL of 50% methylene chloride/hexane (v/v) and collect the eluate in a hexane-rinsed 6 dram vial with a Teflon-lined cap. Mark the solvent level, seal with Teflon tape, and archive.

8.3.2.12 Dispose of the bottom column in the manner described in 8.3.1.7.

8.3.2.13 Concentrate the 20% $MeCl_2$/hexane fraction under N_2 stream to a 2-3 mL volume. Transfer the sample to a hexane-rinsed reacti-vial using a hexane-rinsed pasteur pipet. Rinse the 6 dram vial (3x) with 1 mL hexane and add the rinses to the sample. Add the appropriate volume of tridecane and concentrate the sample under N_2 stream to the final volume of tridecane.

8.3.1.14 At this point, the sample must be screened for high PCDD/PCDF concentration and/or gross contamination. See Section 9.1 for screening of sample extracts.

8.3.1.15. If the sample is too concentrated, the appropriate calculations will be performed to determine the final concentration of the sample. If the sample is found to be grossly contaminated, then the sample will be subjected to further cleanup procedures; see Section 8.4.

Chemists:
R Adelson
P. Perkins

Reviewed by/date:
M Whitacre 1-22-88

NITROGEN CONCENTRATION OF SAMPLE EXTRACTS

PROJECT NO.: 89101.02.14
DATE: ~~1/5/88~~ 1/11/88

1/5/88

SAMPLE NO.	ORIGINAL SOLVENT	(SOLVENT CHANGE ONLY) FINAL SOLVENT	LOT NO.	FINAL VOLUME	RECOVERY INTERNAL STANDARD ADDED DATE	STD ID.	VOLUME ADDED	FINAL VOLUME
QA 4514 spike	MeCl2	Hexane	RJ 383	1ml				
QA 4515 blank	MeCl2							
1011-1013	Toluene							
2011-2013								
3011-3013								
QA spike 4516								
QA blank 4517								
2014-2016								
1014-1016	↓	↓	↓	↓				

1/11

TOTAL AMOUNTS SPIKED PER ____ uL ADDED

ANALYTE	AMOUNT

COMMENTS or MODIFICATIONS TO PROTOCOL:

25 ul Tridecane Lot # 02403PP was added to every sample before solvent exchange.
Sample #1014-1016 + #2014-2016 were deep bright orange in color. When concentrated, a burnt orange ring formed and remained after solv. exchange

8.2 N₂ Concentration of Sample Extracts

8.2.1 The disposable pipets used as needles for the N_2 evaporator should be rinsed with hexane.

8.2.2 Adjust the N_2 stream so that gentle waves are seen on the solvent surface. Concentrate to required volume.

8.2.3 When a solvent change is required (e.g., from benzene to hexane, from $MeCl_2$ to hexane), the sample should be concentrated to a very small volume (approximately 300 µL). Add 1 to 3 mL of the appropriate solvent, and concentrate to approximately 300 µL. Repeat again and concentrate to the final volume.

8.2.4 If a "keeper" (such as tridecane) is required, as in the analysis for PCDD/PCDF, the sample is transferred with appropriate rinses to a solvent-rinsed reacti-vial. The keeper is added and the sample is concentrated under N_2 stream to the final volume.

CHEMISTS: ____ (conc'n)
____ (conc'n)
____ (RIS spiking)

Reviewed by/date: M. Whitacre 1-22-88

Validated by/date: ____

PROJECT NO.: 89101-02-14
DATE: 1/11-1/12

NITROGEN CONCENTRATION OF SAMPLE EXTRACTS

		(SOLVENT CHANGE ONLY)			RECOVERY INTERNAL STANDARD ADDED				TOTAL AMOUNTS SPIKED PER ____ uL ADDED	
SAMPLE NO.	ORIGINAL SOLVENT	FINAL SOLVENT	LOT NO.	FINAL VOLUME	DATE	STD ID.	VOLUME ADDED	FINAL VOLUME	ANALYTE	AMOUNT
1/11 3014-3016	Toluene	Hexane	AQ220	1ml						
1028-1032										
1/12 QA 4513 Blank										
QA 4512 Spike										
QA 4518 Spike										
QA 45A Blank										
F-130										
F-145			↓	↓						
E-176	↓	↓								

COMMENTS or MODIFICATIONS TO PROTOCOL:

25 ul tridecane lot # 02403PP was added to every sample before solvent exchange,
Sample # 3014-3016 + # 1028-1032 were deep burnt orange in color. When concentrated, a burnt orange ring formed and remained after solvent exchange.

8.2 N_2 Concentration of Sample Extracts

8.2.1 The disposable pipets used as needles for the N_2 evaporator should be rinsed with hexane.

8.2.2 Adjust the N_2 stream so that gentle waves are seen on the solvent surface. Concentrate to required volume.

8.2.3 When a solvent change is required (e.g., from benzene to hexane, from $MeCl_2$ to hexane), the sample should be concentrated to a very small volume (approximately 300 µL). Add 1 to 3 mL of the appropriate solvent, and concentrate to approximately 300 µL. Repeat again and concentrate to the final volume.

8.2.4 If a "keeper" (such as tridecane) is required, as in the analysis for PCDD/PCDF, the sample is transferred with appropriate rinses to a solvent-rinsed reacti-vial. The keeper is added and the sample is concentrated under N_2 stream to the final volume.

CHEMISTS: ____ (conc'n)
____ (conc'n)
____ (RIS spiking)

Reviewed by/date:
M. Whitacre 1-22-88

Validated by/date:
____

NITROGEN CONCENTRATION OF SAMPLE EXTRACTS

PROJECT NO.: 8913LA2 14
DATE: 1/12

		(SOLVENT CHANGE ONLY)			RECOVERY INTERNAL STANDARD ADDED				TOTAL AMOUNTS SPIKED PER ____ uL ADDED	
SAMPLE NO.	ORIGINAL SOLVENT	FINAL SOLVENT	LOT NO.	FINAL VOLUME	DATE	STD ID.	VOLUME ADDED	FINAL VOLUME	ANALYTE	AMOUNT
1/12										
15012-15016	Toluene	Hexane	AQ080	1ml						
13012-13016	↓	↓	↓	↓						
18012-18016	↓	↓	↓	↓						
1/13										
20028-20032	Toluene	Hexane	AQ080	1mL						
30028-30032	↓	↓	↓	↓						

COMMENTS or MODIFICATIONS TO PROTOCOL:

25 ul tridecane Lot # 02403 AP was added to every aliquots before solvent exchange.

8.2 N_2 Concentration of Sample Extracts

8.2.1 The disposable pipets used as needles for the N_2 evaporator should be rinsed with hexane.

8.2.2 Adjust the N_2 stream so that gentle waves are seen on the solvent surface. Concentrate to required volume.

8.2.3 When a solvent change is required (e.g., from benzene to hexane, from $MeCl_2$ to hexane), the sample should be concentrated to a very small volume (approximately 300 µL). Add 1 to 3 mL of the appropriate solvent, and concentrate to approximately 300 µL. Repeat again and concentrate to the final volume.

8.2.4 If a "keeper" (such as tridecane) is required, as in the analysis for PCDD/PCDF, the sample is transferred with appropriate rinses to a solvent-rinsed reacti-vial. The keeper is added and the sample is concentrated under N_2 stream to the final volume.

CHEMISTS: V. Parker (conc'n)
K. Anderson (conc'n)
(RIS spiking)

Reviewed by/date:
M. Whitacre 1-22-88

Validated by/date:

NITROGEN CONCENTRATION OF SAMPLE EXTRACTS

PROJECT NO.: 8910408 14
DATE: 4/26/88 + 11/22/88

RECOVERY INTERNAL STANDARD ADDED

SAMPLE NO.	ORIGINAL SOLVENT	(SOLVENT CHANGE ONLY) FINAL SOLVENT	LOT NO.	FINAL VOLUME	DATE	STD ID.	VOLUME ADDED (µl)	FINAL VOLUME (µl)
1014-1016	20% MeCl2/Hex	Tridecane	A8493PP	23 ul ~~25 ul~~	9/11/87	1090:42	2	25
2011-2013	↓	↓	↓	↓	↓	↓	↓	↓
1028-1032								
2014-2016								
2028-2032								
3011-3013								
3014-3016								
3028-3032								
3012-3016								

TOTAL AMOUNTS SPIKED PER 2 uL ADDED

ANALYTE	AMOUNT
^{13}C 1,2,3,4 TCDD	2.35 ng
^{13}C 1,2,3,7,8,9 HxDD	5.0 ng

COMMENTS or MODIFICATIONS TO PROTOCOL:

Analysis Option: PCDD/PCDFs

Sample 3014-3016 fell into water bath on N2-evap. Possible contamination from water and no apparent loss of sample.

8.2 N_2 Concentration of Sample Extracts

8.2.1 The disposable pipets used as needles for the N_2 evaporator should be rinsed with benzene.

8.2.2 Adjust the N_2 stream so that gentle waves are seen on the solvent surface. Concentrate to required volume.

8.2.3 When a solvent change is required (e.g., from benzene to hexane, from $MeCl_2$ to hexane), the sample should be concentrated to a very small volume (approximately 300 µL). Add 1 to 3 mL of the appropriate solvent, and concentrate to approximately 300 µL. Repeat again and concentrate to the final volume.

8.2.4 If a "keeper" (such as tridecane) is required, as in the analysis for PCDD/PCDF, the sample is transferred with appropriate rinses to a solvent-rinsed reacti-vial. The keeper is added and the sample is concentrated under N_2 stream to the final volume.

CHEMISTS: C. Bahr (conc'n)
_______ (conc'n)
JR 11/29/88 (RIS spiking)

Reviewed by/date: _______

Validated by/date: _______

NITROGEN CONCENTRATION OF SAMPLE EXTRACTS

PROJECT NO.: ________
DATE: 1/29/88

					RECOVERY INTERNAL STANDARD ADDED			
SAMPLE NO.	ORIGINAL SOLVENT	(SOLVENT CHANGE ONLY) FINAL SOLVENT	LOT NO.	FINAL VOLUME	DATE	STD ID.	VOLUME ADDED(µl)	FINAL VOLUME(µl)
15A12-15A16	20% MeCl2/Hex	Toluene	0780378	25µl	9/11/87	1090:43DH2B	2	25
18A12-18A16	↓		↓	↓	↓	↓	↓	↓
E-130	↓		↓	↓	↓	↓	↓	↓
E-145	↓		↓	↓	↓	↓	↓	↓
E-176	↓		↓	↓	↓	↓	↓	↓

TOTAL AMOUNTS SPIKED PER 2 dL ADDED

ANALYTE	AMOUNT
^{13}C 1,2,3,4 TCDD	2.35 ng
^{13}C 1,2,3,7,8,9 HxCDD	5.0 ng

COMMENTS or MODIFICATIONS TO PROTOCOL:

Analysis Option: PCDD/PCDFs

CHEMISTS: ________ (conc'n)
________ (conc'n)
D 1/29/88 (RIS spiking)

Reviewed by/date:

Validated by/date:

8.2 **N2 Concentration of Sample Extracts**

8.2.1 The disposable pipets used as needles for the N_2 evaporator should be rinsed with hexane.

8.2.2 Adjust the N_2 stream so that gentle waves are seen on the solvent surface. Concentrate to required volume.

8.2.3 When a solvent change is required (e.g., from benzene to hexane, from $MeCl_2$ to hexane), the sample should be concentrated to a very small volume (approximately 300 µL). Add 1 to 3 mL of the appropriate solvent, and concentrate to approximately 300 µL. Repeat again and concentrate to the final volume.

8.2.4 If a "keeper" (such as tridecane) is required, as in the analysis for PCDD/PCDF, the sample is transferred with appropriate rinses to a solvent-rinsed reacti-vial. The keeper is added and the sample is concentrated under N_2 stream to the final volume.

NITROGEN CONCENTRATION OF SAMPLE EXTRACTS

PROJECT NO.: 8910-02-14
DATE: [illegible]

		(SOLVENT CHANGE ONLY)			RECOVERY INTERNAL STANDARD ADDED			
SAMPLE NO.	ORIGINAL SOLVENT	FINAL SOLVENT	LOT NO.	FINAL VOLUME	DATE	STD ID.	VOLUME ADDED(µl)	FINAL VOLUME(µl)
QR 4512	20% MeCl2/Hex	Tridecane	A2403[illegible]	~~25 µl~~ 23 µl	9/11/87	1090-42 mix B	2	25
QR 4513								
QR 4514								
QR 4515								
QR 4516								
QR 4517								
QR 4518								
QR 4519								
1011-1013								

TOTAL AMOUNTS SPIKED PER 2 uL ADDED

ANALYTE	AMOUNT
13C-1,2,3,4-TCDD	0.35ng
13C-1,2,3,7,8,9-HxCDD	5.0ng

COMMENTS or MODIFICATIONS TO PROTOCOL: Analysis Option: PCDD/PCDFs

8.2 N2 Concentration of Sample Extracts

8.2.1 The disposable pipets used as needles for the N_2 evaporator should be rinsed with hexane.

8.2.2 Adjust the N_2 stream so that gentle waves are seen on the solvent surface. Concentrate to required volume.

8.2.3 When a solvent change is required (e.g., from benzene to hexane, from $MeCl_2$ to hexane), the sample should be concentrated to a very small volume (approximately 300 µL). Add 1 to 3 mL of the appropriate solvent, and concentrate to approximately 300 µL. Repeat again and concentrate to the final volume.

8.2.4 If a "keeper" (such as tridecane) is required, as in the analysis for PCDD/PCDF, the sample is transferred with appropriate rinses to a solvent-rinsed reacti-vial. The keeper is added and the sample is concentrated under N_2 stream to the final volume.

CHEMISTS: ______ (conc'n)
______ (conc'n)
______ (RIS spiking)

Reviewed by/date: ______

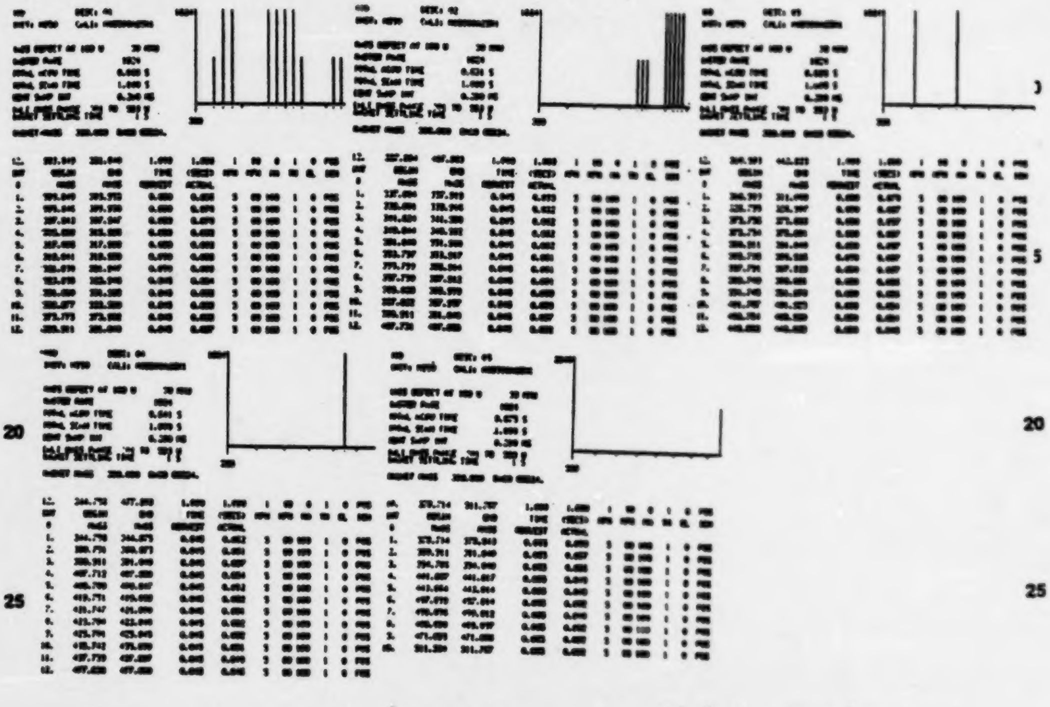
Validated by/date: ______

G.4 Notebook Pages - GC/MS

MRI Project No.: 8984-02-02 **Performed by (name/date):** Kelly Thornburg 1-25-88
Title/Purpose: O'Brien/Greene D/F's - Molloy

Continued from: – **Continued to:** 51 **Entered by:** KRT **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

Tuned @ m/z 305 for max sens R>3000
Set magnet at m/z 300
DB5-GCN GC Program = 200-2H-220-5/-16H-235-5/-7H-330-5/-5H
MID300H25XH PFK Calibration MG=2.5 PFK-30 Filter=300Hz
Range= m/z 301-593
Updated descriptors 01,02,03,04 & 05 for new calibration (see below).



8984A25X0H ( ) Window Defining Mix 1µl inj Separation is good.
MG=3.4 Ions are weak. I Checked for leaks in injector and tightened all fittings.
Switch points are: 01→02 *2030
02→03 *2500
03→04 *2850
04→05 *3150

MRI Project No.: 8984L-02-02 **Performed by (name/date):** R Robson DYR 1/28/88
Title/Purpose: O'Brien/Gen D/F's - Molloy

Continued from: **Continued to:** **Entered by:** RLR RM **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

New septum, cleaned liner, tuned to m/z 35. for max sens. :334

MIP300A28X1 (6:13) PFK CALIBRATION m.6=2.5 PFK=30 Filter=300 HZ
30 sec scan Range 301→593

m.6=3.4 UPDATE DESCRIPTORS 01,02,03 04,05

/ 8984A28XQ1 (6:31) Window Defining Mix 1μl inj
% Valley = 11.0% Δ SWITCHPOINT CHANGED 2030→2065

/8984A28XQ2 (7:42) 980-75 DF100 PCDD/F MIXED STD 100→500 pg/μl 1μl inj
DIDNT PASS 1,2,3,7,8 PentC/F +30% ; 1,2,3,7,8 PentC/F +31%
2,3,4,7,8 PentC/F +32% A_{332}= 879472 A_{402}=1522630

/8984A28XQ3 (8:58) 980-75 DF100 Mixed STD Repeat 1μl inj
DIDNT PASS A_{332}= 794976 A_{402}= 1461230
1,2,3,4,8 PentC/F +30% 1,2,3,7,7,8 HxF 23%
2,3,4,7,8 PentC/F +37%

clip 1 turn from column & Repeat STD

·8984A28XQ4 (11:15) 980-75 DF100 Mixed STD Repeat 1μl inj
DIDNT PASS (Run new Curve M.Molloy) A_{332}= 892768 A_{402} = 1723890

8984A28XQ5 (12:39) 980-75 DF10 Mixed STD PCDD/F 10-50 pg/μl 1μl inj
(M.Molloy SAID RUN NEW 3POINT CURVE) A_{332}=1117240 A_{402} = 1728590

8984A28XQ6 (1526) 980-75 DF500 PCDD/F MIXED STD 500-2500 pg/μl 1μl inj CURVE PASSED
(DM rerun) SHOT 1-28-88 SPLIT rerun A_{332} 879781 A_{402} 1728570

-8984A28X~~Q1~~ 1 (1706) 9100-9104 1μL inj
A_{332} 1231870 A_{402} 2339350

- 8984A28X2 (1809) 1070-1074 1μL inj
A_{332} 1513180 A_{402} 2549340

· 8984A28X3 (1910) rerun as per ~~protocol~~ Sheet Table 1 pg.4
A_{332} 1376470 A_{402} 2295070

- 8984A28X4 (2012) 3070-3074 1μL inj
A_{332} 1089820 A_{402} 2057100

8984A28X5 (2113) 5070-5074 1μL inj
A_{332} 1469910 A_{402} 2539420

/ 8984A28XQ7 (2213) 980-75 DF100 100-500 pg/μL std 1μL inj
A_{332} 1051230 A_{402} 2140440

±25% RRF's

R. Robson 18 hrs

MRI Project No.: 8910L02-15 **Performed by (name/date):** P. Robson Rm 1/29/88
Title/Purpose: MERC PCDD/F M Whitacre

Continued from: **Continued to:** **Entered by:** Rm **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

Note: This project starts here but is using the same STANDARDS AS previous project (8984L0202). Instructions from Marilyn Whitacre are to use the STANDARD that finished 8984 (file 8984A29XQ3) as the instrument cal ~~ref~~ verification STANDARD followed by the window defining mix & on with samples. Therefore the calibration curve ~~M10A29~~ M10300A29X1 is still in effect as well as the DATA curve ~~curve~~ from 8984L0202 (see STD RUNS 8984A28X44, 5, & 6).

New → M. Whitacre said to use these three combined with the low level for a 4 point CURVE.

MΔ=3.4 All CONDITIONS SAME
✓ 8910A29XQ1 (14.37) DF54 (980-75) PCDD/F Mixed STD 5-250pg/μl 1μl inj
A_{332}= 815840 A_{402}= 1278700

CALCULATE 4 POINT CURVE WITH 8984A28XQ4, XQ5, & XQ6
plus 8910A29XQ1 -
1630 BR curve passes

8910A29XQ2 (1549) WINDOW Defining MIX 1μl inj
Rm T Valley = 12%

✓ 8910A29XQ3 (1710) 04520 1μL inj
Mgr D. Heaton waits till Mon. 1645 for results A_{332} 884128 A_{402} 1777250

✓ 8910A29X1 (1812) 04512 1μL inj
A_{332} 1556230 A_{402} 2470810

✓ 8910A29X2 (1913) 04513 1μL inj
A_{332} 1395890 A_{402} 2340030

✓ 8910A29X3 (2013) 04514 1μL inj
A_{332} 1813560 A_{402} 2626870

*✓ 8910A29XQ5 (2125) DF100 980-75 100-500pg/μL PCDD/F Std 1μL inj
C13 PeCDF 22% HxCDD 38% A_{332} 882368 A_{402} 1693910

*✓ 8910A29XQ6 (2226) rerun DF100
HxCDD $\begin{cases}25\% \\ 24 \\ 20\end{cases}$ C13 PeCDF 25% A_{332} 804768 A_{402} 1557430

* Data not used

MRI Project No.: 3110L 02-15 **Performed by (name/date):** R Robson 1/30/88
Title/Purpose: MERC PCDD/F M. Whitacre

Continued from: **Continued to:** **Entered by:** RLR **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) **(initials/date)** **(initials/date)**

New Septum, clean liner, tuned for max sensitivity to m/z 381

MID300A30X1 (7:08) PFK CALIBRATION MG=2.5 PFK=30 FILTER=300Hz
Range = 301 → 593 30 sec scan

UPDATE DESCRIPTORS 01, 02, 03, 04, 05 MG=3.4
8910A30XQ1 (7:25) WINDOW Defining Mix 1µl inj
% Valley= Adjust W. window to 2045

8910A30XQ2 (8:43) 980-75 DF-100 PCDD/F Mixed STD 100-500pg/µl 1µl inj
A_{332}= 608768 A_{402}= 1172410

2- no PASS #27 1,2,3,6,7,8 Hx/D ↑ 33% #28 1,2,3,7,8,9 ↑ 21%
called M. Whitacre - no Answer - left message & ran samples

8910A30X1 (10:04) 04515 QA water Spike 1µl inj
A_{332}= 1624510 A_{402}= 2867030

8910A30X2 (11:06) 04516 QA filter Spike 1µl inj
A_{332} 1854390 A_{402} 2952600

8910A30X3 (12:07) 04517 QA filter blk 1µl inj
A_{332} 1808850 A_{402} 3141500

8910A30X4 (13:10) 04518 QA XAD Filter Spike 1µl inj
A_{402}= 1320070 A_{402}= 2072350

8910A30X5 (14:11) 04519 QA XAD Filter Blank 1µl inj
A_{332}= 1657560 A_{402}= 2702110

8910A30X6 (15:15) F-130 EPA Audit 1µl inj
ADJUST WINDOW TO 2030 A_{332}= 1798810 A_{402}= 3351430

8910A30X7 (16:16) F-176 EPA Audit 1µl inj
A_{332}= 1419130 A_{402}= 2142650

8910A30X8 (17:18) F-145 EPA Audit 1µl inj
A_{332}= 1345660 A_{402}= 2291890

8910A30X9 (18:20) 1011-1013 MMS Front half inlet 1µl inj
A_{332}= 1753340 A_{402}= 3102110

8910A30X10 (19:26) 2011-2013 MMS Front half inlet 1µl inj
A_{332}= 1658870 A_{402}= 2559660

8910A30X11 (20:29) 3011-3013 MMS Front half inlet 1µl inj
A_{332}= 2148890 A_{402}= 3817340

8910A30XQ3 (21:31) 980-25 DF 100 PCDD/F Mixed STD 100-500pg/µl 1µl inj
#4 21% #26+28% OK! A_{332}= 456800 A_{402}= 1947610

T - 17 hrs R Robson

MRI Project No.: 8910L02-15 **Performed by (name/date):** R Robson 1/31/88
Title/Purpose: MERC PCDD/F CONTACT: M. Whitacre

Continued from: **Continued to:** **Entered by:** RLR **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

New Septum; cleaned liner; tuned to m/z=381 for max sensitivity
M10300A31X1(8:02) PFK CALIBRATION PFK=3.0 MG=2.5 Filter=300 Hz
30 sec Scan Range= 301 → 593

UPDATE DESCRIPTORS 01; 02; 03; 04; 05
8910A31XQ1(8:16) Window Defining Mix 1μl inj (oci) RLR
% Valley = 11.0% Move window to 2025
I 8910A31XQ2(9:18) 980-75 DF100 PCDD/F Mixed STD 100-500pg/μl 1μl inj
A_{332}= 700192 A_{402}= 1512190
1-NO PASS #26 1,2,3,4,7,8 Hx Dioxin M. Whitacre said to run

I 8910A31X1(10:24) 1014-1016 MMS back half inlet 1μl inj
A_{332}= 1189930 A_{402}= 1670430
I 8910A31X2(11:26) 2014-2016 MMS back half inlet 1μl inj
A_{332}= 1527190 A_{402}= 2322010
I 8910A31X3(12.27) 3014-3016 MMS back half inlet 1μl inj
A_{332}= 1303070 A_{402}= 2148070
N 8910A31X4(13:29) 1028-1032 MMS train outlet 1μl inj
A_{332} = 1665950 A_{402}= 2443070
I 8910A31X5(14:30) 1028-1032 Repeat Injection 1μl inj
A_{332}= 1668940 A_{402}= 2593690
I 8910A31X6(15:32) 2028-2032 MMS TRAIN OUTLET 1μl inj
all systems look OK RLR A_{332}= 674928 A_{402}= 993524
I 8910A31X7(16:33) 3028-3032 MMS Train Outlet 1μl inj
Areas comparable - probably true values - A_{332}=635120 A_{402} =1055920
I 8910A31X8 (17:35) 13012-13016 Proof Blank Outlet 1μl inj
A_{332} = 1310430 A_{402}= 1977350
N 8910A31X9(18:36) 15012-15016 Field Blank OUTLET 1μl inj
A_{332}=1020330 A_{402}= 1498820
I 8910A31X10(19:38) 18012-18016 Post Test Blank Outlet 1μl inj
A_{332}= 1212790 A_{402}= 1759560
I 8910A31XQ3(20:40) 980-75 DF-100 PCDD/F MIXED STD 100-500pg/μl 1μl inj
All PASS!!! A_{332}= 841816 A_{402}= 1472290

R. Robson 15 hrs

1370- 8

MRI Project No.: 8985-09-12 **Performed by (name/date):** Kelly Thornburg 3-18-88
Title/Purpose: PCDD/F - Molloy

Continued from: **Continued to:** **Entered by:** KLT **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

New Septum & liner; Tuned @ m/z 381 for max sens (5 blocks w/ MG = 3.1)

M1D300C18X1 PFK Calibration MG = 2.5 PFK = 3.0 Filter 300 Hz
30 sec Scan Range = m/z 303-593

Updated descriptors 01, 02, 03, 04 & 05 for new calibration.
MG = 3.6 184.8 mass

8985C18XQ1 (8:55) Window Defining Mix 1µl inj
Sensitivity is very low

8985C18XQ2 (9:56) ~~Cal~~ 980-75-DF100 PCDD/F Std. 10-50 pg/µl 1µl inj
2 min splitless time Sensitivity is still low. A332 = 101558 A402 = 222032
I increased the height of the column in the injector by 5 mm.

8985C18XQ3 (11:00) 980-75-DF100 PCDD/F Std. 10-50 pg/µl 1µl inj
100 sec splitless A334 = ~~101558~~ 77407 A402 = ~~222032~~ 121616
Turn MG to 4.0 lowered the column 5 mm
8985C18XQ4 (13:07) 980-75-DF100 PCDD/F Std 10-50 pg/µl 1µl inj
100 sec splitless A334 = 177904 A402 =
I will switch back to the Carlo Erba injector.

8985C18XQ5 (14:34) Window Defining Mix 1µl inj
Valley = 20.2% ~~A334~~ Ck kit ti...

KLT ↓
8985C18XQ6 (1542) 980-75 DF100 10-500 pg/µL Std 1µL inj 325°
CK KIT A_{334} 149497 A_{402} 2081270
8910C18X1 (1647) 1011-1013 dil 1µL inj
A_{334} 2301280 A_{402} 2782140
8910C18X2 (1747) 2011-2013 dil 1µL inj
A_{334} 235770 A_{402} 3211560
8910C18X3 (18~~3~~45) 3011-3013 dil 1µL inj
A_{334} 271968 A_{402} 4152390
8910C18XQ7 (1947) 980-75 DF100 10-500 pg/µL Std 1µL inj
CK Kit A_{334} 168750 A_{402} 2456860

(See Back of Page for Explanation of Numbers)

LABORATORY CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
③ Project Number 8910-02-15
⑤ Location Mrc
⑦ Container Type 40ml glass vial

② ☑ Traceability Log
④ Date of Laboratory Check-in
⑥ Type of Samples D/F
⑧ Custody Office Storage Location Cooler

⑨ Laboratory Sample No.	⑩ Field Sample No.	⑪ Sample Description	⑫ Amount of Sample Removed (give date)	⑬ Comments
3014-3016	25µl	mms Prob's in		
1028-1032	To be duplicate injected	mms out		
2028-2032		mms out		
3028-3032		mms out		
13012-13016		Proof Blank out		
15012-15016		Field Blank out.		
18012-18016	↓	Post test Blk out.		

Laboratory/Area	⑭ Relinquished by: (signature)	⑮ Date/Time	⑯ Received by: (signature)	⑰ Date/Time
Custody Office				
Sample Preparation	J. Kelley	1-29-88 1351	R. R. Rhm	1-29-88 1351
Metals				
GC/MS	Kelly Thornberry	2-2-88 1005	M. Whitacre	2-2-88 1005
Other (Identify)				

⑱ Notebook Reference Pages 69
⑲ Notebook No. 1086
⑳ Analyst Comments

(See Back of Page for Explanation of Numbers)

LABORATORY CHAIN OF CUSTODY OR TRACEABILITY RECORD

① = Chain of Custody Record
② Project Number 8910-02-15
③ Location Menc.
④ Container Type 1ml glass vial

⑤ ✓ = Traceability Log
⑥ Date of Laboratory Check-in
⑦ Type of Samples Dif
⑧ Custody Office Storage Location [illegible]

⑨ Laboratory Sample No.	⑩ Field Sample No.	⑪ Sample Description	⑫ Amount of Sample Removed (give date)	⑬ Comments
F-130	95µl	EPA Audit		
F-176	↓	↓		
F-145				
1011-1013		MM5 Front ½ in		
2011-2013		MM5 Front ½ in		
3011-3013		MM5 Front ½ in		
1014-1016		MM5 Back ½ in		
2014-2016	↓	MM5 Back ½ in		

Laboratory/Area	⑭ Relinquished by: (signature)	⑮ Date/Time	⑯ Received by: (signature)	⑰ Date/Time
Custody Office				
Sample Preparation		1/29/88 1351		[illegible] 1351
Metals				
GC/MS	Kelly Thaburg	2-2-88 1005	M. Whitacre	2-2-88 1005
Other (Identify)				

⑱ Notebook Reference Pages 69
⑲ Notebook No. 1086
⑳ Analyst Comments

(See Back of Page for Explanation of Numbers)

LABORATORY CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② Project Number 8710-03-15
③ Location Misc.
④ Container Type 1ml glass vial

⑤ ☑ Traceability Log
⑥ Date of Laboratory Check-In
⑦ Type of Samples D/F
⑧ Custody Office Storage Location GC/MS

⑨ Laboratory Sample No.	⑩ Field Sample No.	⑪ Sample Description	⑫ Amount of Sample Removed (give date)	⑬ Comments
QA-04512	35µl ↓	XAD Spk		
QA-04513		XAD - Blk		
QA-04514		Water Spk		
QA-04515		Water Blk		
QA-04516		Filter Spk		
QA-04517		Filter Blk		
QA-04518		XAD/Filter Spk		
QA-04519		XAD/Filter Blk		

Laboratory/Area	⑭ Relinquished by: (signature)	⑮ Date/Time	⑯ Received by: (signature)	⑰ Date/Tim
Custody Office				
Sample Preparation		1/29/88 1351		1/29/88 1351
Metals				
GC/MS	Kelly Thornburg	2-2-88 1005	M. Whitacre	2-2-88 1005
Other (Identify)				

⑱ Notebook Reference Pages 69
⑲ Notebook No. 1086
⑳ Analyst Comments

(See Back of Page for Explanation of Numbers)

LABORATORY CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② Project Number 9610-02
③ Location MERC
④ Container Type GLASS VIAL

⑤ ☒ Traceability Log
⑥ Date of Laboratory Check-In
⑦ Type of Samples MMS-EXTRACT
⑧ Custody Office Storage Location O-C Rm

⑨ Laboratory Sample No.	⑩ Field Sample No.	⑪ Sample Description	⑫ Amount of Sample Removed (give date)	⑬ Comments
1011-1013	1011 - 1013	MMS-EXTRACT	5/25 all 3/18/88	
2011-2013	2011 - 2013	MMS-EXTRACT	↓	
3011-3013	3011-3013	MMS-EXTRACT	↓	

Laboratory/Area	⑭ Relinquished by: (signature)	⑮ Date/Time	⑯ Received by: (signature)	⑰ Date/Time
Custody Office				
Sample Preparation		3/18/88 1013		
Metals				
GC/MS			Kelly R. Thornburg	3-18-88 10:13
	Kelly Thornburg	3-25-88 14:35	M. Whitacre	3/25/88 2:3
Other (Identify)				

⑱ Notebook Reference Pages 31 ⑲ Notebook No. 1086

⑳ Analyst Comments

APPENDIX H

LABORATORY ANALYTICAL RESULTS FOR PARTICULATE/METALS

H.1 Particulate Data H-2
H.2 Metals Data H-13

H.1 Particulate Data

TABLE H-1. SUMMARY OF COLLECTED PARTICULATE MASS BY SAMPLE FRACTION FOR MAINE ENERGY RECOVERY CO. (RDF) MWC

Run no.	Sample location	Filter[a] particulate (mg)	Probe[b] acetone rinse particulate (mg)	Front half[c] acetone rinse particulate (mg)	Total acetone rinse particulate (mg)	Probe[b] acetone rinse volume (mL)	Front half[c] acetone rinse volume (mL)	Total acetone rinse volume (mL)	Acetone blank correction factor (mg/mL)	Acetone blank correction (mg)	Corrected total acetone rinse particulate (mg)	Total mass particulate (mg)
1	Spray Dryer Inlet	13110.4 -1030.9 (0.1)[d] 12079.4	79585.3 -78041.3 1544.0	81283.6 -80940.2 343.4	1887.4	458	413	871	0.00076	0.7	1886.7	13966.1
1	Baghouse Outlet	1036.6 -1013.4 (0.1) 23.1	82859.2 -82852.4 6.8	82807.2 -82802.6 4.6	11.4	140	84	224	0.00076	0.2	11.2	34.3
2	Spray Dryer Inlet	18007.6 - 1033.3 (0.1) 16974.2	79290.2 -77368.3 1921.9	78051.7 -77904.8 146.9	2068.8	502	207	709	0.00076	0.5	2068.3	19042.5
2	Baghouse Outlet	1099.9 -1037.3 (0.1) 62.5	78600.4 -78594.1 6.3	83099.8 -83088.0 11.8	18.1	113	133	246	0.00076	0.2	17.9	80.4
3	Spray Dryer Inlet	18390.9 - 1033.7 (0.1) 17357.1	79992.4 -78439.2 1553.2	79504.8 -79231.1 273.7	1826.9	551	178	729	0.00076	0.6	1826.3	19183.4
3	Baghouse Outlet	1104.1 -1025.3 (0.1) 78.7	79845.2 -79841.4 3.8	79333.9 -79319.3 14.6	18.4	92	108	200	0.00076	0.2	18.2	96.9

[a] Includes filter and cyclone (where applicable) catch.

[b] Includes nozzle, probe, and sample tranfer line (where applicable) catches.

[c] Includes cyclone or cyclone bypass and filter holder front half rinses.

[d] Blank filter corrections.

MRI Project No.: 8910L (02-12) **Performed by (name/date):** 11/23-24/87

Title/Purpose: Maine Energy Recovery Co. (MERC) Emissions Test for U.S. EPA MM5 trains (particulate & metals) – Filter tare weights (grams)

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

Mettler H54AR No. 727827
Room 106 N

Filter Weights (Tare) Page 1 of 1

Project Number 8910L (02-12) Crew Chief J. Surman
Project Leader G. Scheil

Sample No	Filter No	First Weight Time 1500 Weight (g)	By	Date	Second Weight Time 0900 Weight (g)	By	Date	Third Weight Time 1600 Weight (g)	By	Date	Avg Wt
N/A	PM-1	1.01474	[illegible]	11/23	1.01477	[illegible]	11/24	1.01476	[illegible]	11/24	1.01476
	PM-2	1.02537	[illegible]	11/23	1.02527	[illegible]	11/24	1.02526	[illegible]	11/24	1.02526
	PM-3	1.03086	[illegible]	11/23	1.03089	[illegible]	11/24	1.03089	[illegible]	11/24	1.03089
	PM-4	1.03368	[illegible]	11/23	1.03368	[illegible]	11/24	1.03368	[illegible]	11/24	1.03368
	PM-5	1.02498	[illegible]	11/23	1.02500	[illegible]	11/24	1.02499	[illegible]	11/24	1.02499
	PM-6	1.03545	[illegible]	11/23	1.03545	[illegible]	11/24	1.03545	[illegible]	11/24	1.03545
	PM-7	1.01336	[illegible]	11/23	1.01341	[illegible]	11/24	1.01340	[illegible]	11/24	1.01340
	PM-8	1.02504	[illegible]	11/23	1.02511	[illegible]	11/24	1.02509	[illegible]	11/24	1.02510
	PM-9	1.01343	[illegible]	11/23	1.01344	[illegible]	11/24	1.01344	[illegible]	11/24	1.01344
	PM-10	1.03327	[illegible]	11/23	1.03327	[illegible]	11/24	1.03327	[illegible]	11/24	1.03327
	PM-11	1.03934	[illegible]	11/23	1.03937	[illegible]	11/24	1.03936	[illegible]	11/24	1.03936
	PM-12	1.03732	[illegible]	11/23	1.03731	[illegible]	11/24	1.03731	[illegible]	11/24	1.03731

11/24/87 0900

Bergmen's Weights	1.00009	5.00042	0.30026
Balance Weight	1.00002	5.00032	0.30015

1285- 6

MRI Project No.: 8910L (02-12) **Performed by (name/date):** 01/04/88 – 01/05/88

Title/Purpose: MERC – Particulate Analysis
Filters & Cyclone Catch

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

Run No.	Sample Location	Sample No.	Filter No.	Particulate Color *	Cyclone Catch Added Sample No.
1	Inlet	1004	PM-3	Grayish-Black	1003
1	Outlet	1020	PM-9	"	N/A
2	Inlet	2004	PM-10	"	2003
2	Outlet	2020	PM-12	"	N/A
3	Inlet	3004	PM-4	"	3003
3	Outlet	3020	PM-2	"	N/A
Filter Blank		N/A	PM-1	N/A	N/A
Filter Blank		1064	PM-7	N/A	N/A

* Outlet samples lighter (more gray) than inlet samples
Coarser particles appear black, finer particles appear gray.
Coarse particles appear to be about up to 60 mesh.

Acetone Blank

MRI Project No.: 8910L(02-12) **Performed by (name/date):** 01/04/88 - 01/05/88
01/12/88 - 01/13/88

Title/Purpose: MERC - Particulate Analysis
Acetone Rinses

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

		Nozzle, Probe, ST Line		Front Half		Cyclone Catch Container Rinse Added before 'Total wt.' below
Run No	Sample Location	Sample No.	Beaker No.	Sample No.	Beaker No.	Sample No.
1	Inlet	· 1001	1	· 1005	7	1003
1	Outlet	· 1017	2	· 1021	8	N/A
2	Inlet	· 2001	3	· 2005	9	2003
2	Outlet	· 2017	4	· 2021	10	N/A
3	Inlet	· 3001	5	· 3005	11	3003
3	Outlet	· 3017	6	· 3021	12	N/A
Acetone Blank		· 1063	13			
Beaker Blank		N/A	14			
Acetone Blank		· 1063	15			

Note: Liquid levels of all samples listed on this page were at the marks — No losses or leakage occurred during shipment.

Sample No.	Total Wt. g	Tare Wt. g	Net Wt. g	Acetone added to Rinse Container, g.	Acetone Weight For Blank Correction. grams
1001	779.20	466.80	312.40	(344.3-293.4)	363.30
1017	545.20	466.30	78.90	(133.0-101.9)	110.0
2001	829.60	465.70	363.90	(218.7-183.85)	398.75
2017	527.75	465.55	62.20	(308.8-281.7)	89.3
3001	833.25	469.00	364.25	(255.4-218.7) (289.2-253.1)	437.05
3017	504.35	469.30	35.05	(281.7-244.1)	72.65
(13) 1063	(882.40-773.55)	(655.40-557.50)			206.75 } combined for metals analysis
(15) 1063	(773.55-655.40)	(557.50-465.05)			210.60 }
1005	754.05	467.90	286.15	(385.3-344.3)	327.05
1021	513.65	466.20	47.45	(152.1-133.0)	66.55
2005	605.75	466.75	139.0	(221.15-196.3)	163.85
2021	536.55	465.65	70.90	(244.1-210.1)	104.90
3005	572.30	469.80	102.50	(210.1-171.8)	140.8
3021	519.70	465.85	53.85	(171.8-139.8)	85.85

All emptied sample containers were rinsed 3X with acetone into respective beakers. Then, all acetone rinsed sample containers and all weighed beakers (final wts) were rinsed with 0.1 N HNO_3 into polyethylene sample containers for metals analysis.

1285- 8

MRI Project No.: 8910L(02-12) **Performed by (name/date):** 01/5-7/88

Title/Purpose: NESL Particulate Analysis - Gross Filter Weights (grams)

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

Mettler AE200 S/N F16741
MRI No. 10586
Room 215W

Filter Weights (Gross)

Page 1 of 1

Project Number 8910L(02-12) Crew Chief J. Surman
Project Leader G. Scheil

Sample No	Filter No	First Weight Time 1630 Weight (g)	By	Date	Second Weight Time 0900 Weight (g)	By	Date	Third Weight Time 0945 Weight (g)	By	Date	Avg Wt
N/A	PM-1	1.0150	[illegible]	1/5/88	1.0149	[illegible]	1/6/88	1.0148	[illegible]	1/7/88	1.0149
3020	PM-2	1.1041	[illegible]	1/5/88	1.1040	[illegible]	1/6/88	1.1042	[illegible]	1/7/88	1.1041
1004	PM-3	13.1166	[illegible]	1/5/88	13.1094	[illegible]	1/6/88	13.1104	[illegible]	1/7/88	13.1104 *
3004	PM-4	18.4040	[illegible]	1/5/88	18.3921	[illegible]	1/6/88	18.3909	[illegible]	1/7/88	18.3909 *
1041	PM-7	1.0135	[illegible]	1/5/88	1.0134	[illegible]	1/6/88	1.0134	[illegible]	1/7/88	1.0134
1020	PM-9	1.0366	[illegible]	1/5/88	1.0364	[illegible]	1/6/88	1.0367	[illegible]	1/7/88	1.0366
2004	PM-10	18.0159	[illegible]	1/5/88	18.0089	[illegible]	1/6/88	18.0076	[illegible]	1/7/88	18.0076 *
2020	PM-12	1.1000	[illegible]	1/5/88	1.0998	[illegible]	1/6/88	1.1000	[illegible]	1/7/88	1.0999

1/7/88 QC check on balance:
0930

Bergman's Weights:	1.0000	20.0001	79.9997
Balance Reading:	1.0000	20.0005	80.0011

* Less than 1 percent of net weight change between second & third weighings. Used third weighing results.

Note: All desiccation done at ambient temperature & pressure.

MRI Project No.: 89102 (02-12) **Performed by (name/date):** 01/6-7/87

Title/Purpose: MERL Particulate Analysis
Evaporation Beakers for Acetone Rinses - Tare Weights (grams)

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

Mettler AE 200 S/N F16741
MRI No. 10586
Room 215W

Beaker Weights (Tare)

Page 1 of 1

Project Number 89101 (02-12)
Project Leader G. Scheil

Crew Chief J. Surman

Used these weights

Sample No	Beaker No	Samp Vol (mL)	First Weight Time 0830 Weight (g)	By	Date	Second Weight Time 1630 Weight (g)	By	Date	Third Weight Time 0900 Weight (g)	By	Date	~~Avg Wt~~
N/A	1	N/A	78.0415		1/6/88	78.0410		1/6/88	78.0413		1/7/88	
	2		82.8528		1/6/88	82.8522		1/6/88	82.8524		1/7/88	
	3		77.3685		1/6/88	77.3680		1/6/88	77.3683		1/7/88	
	4		78.5943		1/6/88	78.5938		1/6/88	78.5941		1/7/88	
	5		78.4395		1/6/88	78.4389		1/6/88	78.4392		1/7/88	
	6		79.8416		1/6/88	79.8411		1/6/88	79.8414		1/7/88	
	7		80.9404		1/6/88	80.9398		1/6/88	80.9402		1/7/88	
	8		82.8029		1/6/88	82.8024		1/6/88	82.8026		1/7/88	
	9		77.9050		1/6/88	77.9044		1/6/88	77.9048		1/7/88	
	10		83.0882		1/6/88	83.0876		1/6/88	83.0880		1/7/88	
	11		79.2314		1/6/88	79.2307		1/6/88	79.2311		1/7/88	
	12		79.3195		1/6/88	79.3190		1/6/88	79.3193		1/7/88	
	13		75.2936		1/6/88	75.2930		1/6/88	75.2934		1/7/88	
	14		66.2285		1/6/88	66.2279		1/6/88	66.2281		1/7/88	
	15		66.3668		1/6/88	66.3662		1/6/88	66.3666		1/7/88	
											~~1/7/88~~	

MRI Project No.: 8910L(02-12) **Performed by (name/date):** 01/14/88

Title/Purpose: MERL Particulate Analysis

Evaporation Beakers for Acetone Rinses - Gross Weight (grams)

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

Mettler AE200 S/N F16741
MRI No. 10586
Room 215W

Beaker Weights (Gross)
Acetone Rinses

Page 1 of 1

Project Number 8910L(02-12)
Project Leader G. Scheil

Crew Chief J. Surman

Sample No	Beaker No	Samp Vol (mL)	First Weight Time 0830			Second Weight Time 1700			Third Weight Time			Avg Wt
			Weight (g)	By	Date	Weight (g)	By	Date	Weight (g)	By	Date	
1001	1		77.5855	[illegible]	1/14/88	77.5850	[illegible]	1/14/88				77.5853
1012	2		82.8594	[illegible]	1/14/88	82.8590	[illegible]	1/14/88				82.8592
2001	3	See Page 7 in [illegible] Book	79.2899	[illegible]	1/14/88	79.2904	[illegible]	1/14/88				79.2902
2012	4		78.6002	[illegible]	1/14/88	78.6005	[illegible]	1/14/88				78.6004
3001	5		79.9323	[illegible]	1/14/88	79.9325	[illegible]	1/14/88				79.9324
3012	6		79.8450	[illegible]	1/14/88	79.8454	[illegible]	1/14/88				79.8452
1005	7		81.2834	[illegible]	1/14/88	81.2838	[illegible]	1/14/88				81.2836
1021	8		82.8070	[illegible]	1/14/88	82.8074	[illegible]	1/14/88				82.8072
2005	9		78.0518	[illegible]	1/14/88	78.0515	[illegible]	1/14/88				78.0517
2021	10		83.0996	[illegible]	1/14/88	83.0999	[illegible]	1/14/88				83.0998
3005	11		79.5047	[illegible]	1/14/88	79.5049	[illegible]	1/14/88				79.5048
3021	12		79.3337	[illegible]	1/14/88	79.3340	[illegible]	1/14/88				79.3339
1063	13		75.2930	[illegible]	1/14/88	75.2942	[illegible]	1/14/88				75.2936
Beaker Blk	14		66.2281	[illegible]	1/14/88	66.2284	[illegible]	1/14/88				66.2283
1063	15		66.3666	[illegible]	1/14/88	66.3670	[illegible]	1/14/88				66.3668

Note: All evaporations were performed at ambient temp and pressure.

MRI Project No.: 8910L(02-12) **Performed by (name/date):** 01/11/88 - 01/13/88 - 01/14/88

Title/Purpose: MERC - Metals Analysis
Acetone Rinses from Probe & Blank Trains

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

Sample No.	Beaker	Total wt (g)	Tare wt (g)	Net wt (g)	Acetone Added to Rinse Container, g.	Acetone Wt for Blank Correction grams
11005	A	518.10	464.30	53.8	(251.3-229.00)	76.1
16001	B	495.45	465.75	29.7	(271.4-251.3)	49.8
16005	C	496.05	466.20	29.85	(296.70-271.4)	55.15
18001	D	538.10	466.20	71.9	(323.10-296.70)*	~~93.5~~ 36.5 (acetone only)
18005	E	504.90	468.00	36.9	(339.60-323.10)	53.4
18002	F	528.25	468.35	59.9	(281.20-255.35)	85.75

Note: liquid levels of all samples listed above on this page were at the marks - No losses or leakage occurred during shipment. These samples were transferred to beakers (cleaned for metals) and the acetone was evaporated at ambient temperature and pressure. The original empty sample containers were rinsed with 0.1 N HNO_3 and these rinses were transferred along with the residues in the beakers to polyethylene sample containers for metals analysis.

All acetone used for this project is
American Burdick & Jackson
Product 010
Lot AQ950

* Not all acetone? Some aqueous matter in sample (seen when acetone rinses added)

Wt Beaker D + aqueous = 123.2 g Aqueous pH = 1
Wt Beaker = 61.4 g
61.8 g original sample wt. (aqueous only)

Sample 18002 was an acetone rinse. Apparently samples nos. 18001 and 18002 were switched (not labeled correctly) in the field. These samples still have the original nos and no correction was made here or in transfer to the metals lab.

Sample 18001 was returned to original sample container 536.70 g sample + container
70.5 g sample wt. to metals lab.

1285- 12

MRI Project No.: 8910L(02-12) **Performed by (name/date):** 01/15/87
Title/Purpose: MEEC Particulate Analysis
Acetone Blank corrections
Continued from: **Continued to:** **Entered by:** **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

Run No	Location	Total Wt Sample grams	Particulate Wt grams	Acetone Wt grams	Acetone * Volume, mls
1	Inlet	690.35	1.89	688	871
1	Outlet	176.55	0.01	177	224
2	Inlet	562.60	2.07	560	709
2	Outlet	194.20	0.02	194	246
3	Inlet	577.85	1.83	576	729
3	Outlet	158.5	0.02	158	200
Blank		417.35	0.00	417	528

* Using $\rho_a = 0.79$

$$\text{Acetone Blank} = \frac{0.4\ \text{mg}}{528\ \text{ml}} = 0.00076\ \text{mg/ml}$$

(See Back of Page for Explanation of Numbers)

CHAIN OF COUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☑ Traceability Log
③ Project Number 8910L(02-12)
④ Date of Field Sampling 12/9-12/87
⑤ Location MRI
⑥ Type of Sample Particulate/Metals Train
⑦ Container No.
⑧ Storage Requirements Keep Cool

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check				⑭ Comments
1004/1003/1005	Filter, Cyclone Inlet Fr Hlf Rinse Run1	500ml Bottle	N/A	✓				All bottles polyethylene
2004/2003/2005	" Run2	"		✓				except as noted.
3004/3003/3005	" Run3	"		✓				
1020/1021	Filter Outlet Fr Hlf Rinse Run1	"		✓				
2020/2021	" Run2	"		✓				
3020/3021	" Run3	"		✓				
1064	Blank Filter	"		✓				
1001	Nozzle Probe Inlet S-Line Run1	50ml Bottle		✓				
2001	" Run2	"		✓				
3001	" Run3	"		✓				
1017	Nozzle Probe Outlet Run1	"		✓				
2017	" Run2	"		✓				
3017	" Run3	"		✓				
1063	Acetone Blank	"		✓				
11005/11001	Total Fr Hlf Rinse Outlet Train Proof	"		✓				
16001	Probe Rinse Outlet Train Blank	"		✓				
16005	Front Half Rinse Outlet Train Blank	"		✓				
18001	Probe Rinse Outlet Post-Test Proof	32oz Bottle		✓				Glass bottle
18005	Front Half Rinse Outlet Post-Test Proof	50 ml Bottle		✓				
18002	Probe Rinse Outlet Post-Test Proof	"		✓				

⑮ Date 1/15

⑯ Seal Intact												
⑰ Date	1/15/88											
⑱ Checked by (Initials)												

⑲ Relinquished by				
⑳ Date	1/15/88			
㉑ Time	1-15-88			
㉒ Received by				

H.2 Metals Data

INTEROFFICE COMMUNICATION

MIDWEST RESEARCH INSTITUTE

May 5, 1988

To: G. Scheil

From: E. McClendon EM 5-9-88

Subject: Sample Analysis Results for Maine Energy Recovery Company Trial Burn Sampling; Project 8910L

Please find enclosed the results for the sample analyses (ICAP, GFAA and CVAAS) for the samples from the Maine Energy Recovery Company (MERC) Trial Burn conducted in December, 1987.

I. Introduction and Request for Analysis

These samples were submitted for analysis after the trial burn at MERC. The analytes of interest were As, Cd, Cr (total), Hg and Pb. Also submitted were four audit samples from the EPA, which were required to be analyzed for As, Cd, Cr and Pb prior to any sample analyses for these elements. The analyses were conducted on the Jarrell-Ash Model 1155A ICP-AES, the the Perkin-Elmer Plasma II ICP-AES, the Perkin-Elmer Model 5000 Zeeman atomic absorption spectrometer, and the Perkin-Elmer Model 3030B atomic absorption spectrometer.

II. Sample Preparation

The submitted samples were prepared according to the protocol as described in the EMB Draft Metals Protocol, a copy of which is included in this report as Appendix A.

All samples except the impinger contents (X007 series) were digested with hydrofluoric acid in microwave digestion bombs at the Environmental Trace Substances Research Center (ETSRC) in Columbia, MO. This digestion is considered what is called a "complete" digestion, that is, samples are normally completely dissolved, even those with a high silica content. Digetsion times were modified from those presented in the EMB Protocol due to the digestion of up to 9 samples at a time in the microwave oven. Final dilutions on these samples were made with 0.5 M boric acid to reduce the destructive action of hydrofluoric acid on instruments through complexation.

Difficulties were encountered in these digestions along two fronts. The high ash content of the samples combined with the sealed microwave bombs resulted in dark particulate matter being left in the samples. Based on past experience, it was speculated by personnel at ETSRC that these particulates were composed of carbon. In open beaker digestions, carbon is generally expelled from the sample as carbon dioxide, but in a sealed system such as the microwave bomb, this is inhibited from occurring. A second problem was the excessive size (weight) of some of the samples. Multiple digestions in the bombs were required to digest all of a sample with large weight, resulting in large (as much as 1 L) digested sample volume and poorer sample detection limits. Some of the samples with large weight were combinations of solids and liquids. The digestion of these type of samples was not addressed in the EMB Protocol, where the digestion was to involve either approximately 0.5 g of solid or a small volume (less than 30 mL) of liquid. A comprimise between these two values was used for these solid/liquid samples, using less than 10 g of these sample types per digestion bomb.

The impinger contents were reduced in volume and digested according to the conventional digestion listed in the EMB Draft Metals Protocol at MRI. No difficulties were encountered in the digestion of these samples.

III. Audit Sample Analyses

The four audit samples were analyzed on the Jarrell-Ash Model 1155A ICP-AES for Cd, Cr and Pb and on the Perkin-Elmer Plasma II ICP-AES for As. Both analyses were conducted according to EPA SW-846 Method 6010 and the instrumental parameters are detailed on the associated sheets in the data packet with the raw sample analysis data. Standards were prepared in the same matrix as the digested audit samples and at appropriate concentrations. This standard preparation is documented in the notebook pages for these analyses.

The initial results (as presented in Tables 1 and 2) were acceptable (within 10 percent of the expected results) except for Cr in audit sample 102, which was 35 percent above an expected Cr result of 125 mcg. Reanalyses and standard addition analyses yielded very nearly the same results as the initial result for this sample for Cr. After conversations with Dennis Hooton, yourself and Gene Riley of the EPA, it was decided that this sample would be reanalyzed with the next ICP analysis along with another EPA check sample, available in ampule form. The results of these reanalyses, along with the check sample WP 283 Conc. #1, are also presented in Table 1. It should be noted that both samples were analyzed in these later analyses at a 1:5 dilution to minimize the amount of audit sample 102 required. The audit sample results are again nearly the same, while the WP 283 Conc. #1 sample varied from its true value (1.25 mcg/mL) by less than 7.2 percent in both analyses.

IV. Sample Analysis Data

The following tables are included in this report. Also included in this report are the Lotus 1-2-3 cell formulas and a copy of Table 3 showing the hidden columns for inclusion in the final report.

Table No.	Description
1	Results of Audit Sample Analysis
2	Raw Data for Audit Sample Analysis
3	Raw Data for Project Samples
4	Final Sample Results for Project 8910L
5	ICS and Percent Drift Calculations

6	Duplicate and Percent Difference Results
7	Spike and Percent Recovery Data
8	Pb GFAA Analysis Raw Data 3-31-88
9	As GFAA Analysis Raw Data 4-1-88
10	As GFAA Analysis Raw Data 4-4-88
11	Pb GFAA Analysis Raw Data 4-8-88
12	Hg CVAAS Analysis Raw Data 1-7-88
13	Hg CVAAS Analysis Raw Data 4-9-88
14	Hg CVAAS Analysis Raw Data 4-13-88
15	Hg CVAAS Analysis Raw Data 4-14-88

V. ICP Instrumental Analyses

The samples were analyzed for Cd, Cr and Pb on the Jarrell-Ash Model 1155A ICP-AES according to Method 6010 (with deviations as documented in Appendix B) after an appropriate warm up period for the instrument. Three analyses were required to complete the ICP analyses of all samples. As for the audit samples, the standards were prepared for the analyses in the same matrix as the samples and at appropriate concentrations and this preparation was described on the notebook pages pertinent to these analyses. The instrumental parameters for each analysis were recorded on the ICP-AES Data Reporting Sheet corresponding to each analysis. Channels for Fe and Al were also calibrated to perform any interelement corrections which may have been necessary.

VI. GFAA Instrumental Analyses

The samples were analyzed for As and Pb on the Perkin-Elmer Model 5000 Zeeman atomic absorption spectrometer according to EPA SW-846 Methods 7060 (As) and 7421 (Pb), with deviations as documented in Appendix B. The instrument was allowed to warm up for an appropriate amount of time prior to beginning analysis and four analyses were requried on this graphite furnace unit to complete these analyses. The instrument parameters for each analysis are recorded on the Atomic Absortpion Data Reporting Sheet for each analysis. The high boric acid content of most samples did not allow for GFAA analysis of the samples without dilution. Most samples had to be diluted minimally 1:10 for analysis. Standards were prepared at appropriate concentrations in the matrix of the diluted samples and was recorded on the notebook pages pertinent to these analyses. The data for these analyses can be found in Tables 8-11.

VII. CVAAS Instrumental Analyses

The samples were analyzed for Hg on the Perkin-Elmer Model 5000 and the Perkin-Elmer Model 3030B atomic absorption spectrometer, either unit employing the MHS-10 cold vapor generation accessory. The permanganate containing impingers (X007 series) and the combined impingers (X004 series) were carried through this method without prior digestion. All other samples were digested prior to analysis by this method. The samples were analyzed according to EPA SW-846 Method 7470, with the deviations as in Appendix B. Both units were allowed to warm up an appropriate amount of time before analyses were begun. Standards were prepared as described on the notebook pages for these analyses and preparation of the stock solutions needed for the digestion contained within the method were also recorded on the notebook pages. The data for these analyses are contained in Tables 12-15.

One sample, 18002, was inadvertently not reanalyzed after it had been analyzed during an analysis whose check standard had drifted beyond an acceptible value (20%). Since the drift check standard absorbance had drifted up in value, it was felt that the sample was likely less than the value obtained in that analysis, and so is reported that way. The sample will be reanalyzed at the earliest possible time, likely within the next two weeks.

VIII. Internal Quality Control

The detection limit for the analyses were determined from the data generated during the analysis and/or data from other similar analyses. The detection limit for Jarrell-Ash Model 1155A and Perkin-Elmer Plasma II ICP-AES analyses were determined from direct output from those instruments and was defined as two times the highest standard deviation of the calibration blank analyses performed throughout sample analysis. The detection limit for atomic absorption (GFAA and CVAAS) analyses was defined as three times the standard deviation of the absorbance of a standard or sample (analyzed multiply) divided by the slope of the calibration curve for that analysis. Some CVAAS analyses did not have the detection limit determination performed on them at the time of analysis. For these analyses, the standard deviation used for the detection limit was the highest one obtained for all CVAAS runs which had detection limit determinations.

All analyses were conducted according to the protocols set forth in the EPA SW-846 methods for each analysis. All protocol requirements were met for the reported analyses with the exception of the Hg CVAAS result for sample 18002 (discussed earlier).

Duplicate analyses showed percent differences of less than 20 percent (project requirement), except for the As result for sample 1033 (duplicates 04260 and 04261). These results are presented in Table 5. Many results were less than the detection limit, for whom a percent difference could not be calculated.

An NBS Standard Reference Material, SRM 1633a, was prepared with the ash and lime slurry samples to demonstrate recovery during digestion of these samples. This sample (MRI bar code 04272) showed recoveries of between 118 and 153 percent, with two elements (Cd and Hg) below the detection limit. A blank filter (MRI bar code 04380) was spiked and sent with the remaining samples to ETSRC for digestion. The recoveries on this filter were between 99.5 and 118 percent for the spiked elements. An impinger spiked sample (MRI bar code 09095) was prepared with the impinger contents as described in the EMB Draft Protocol. This sample showed recoveries of between 103 and 117 percent for the target analytes for which it was spiked. Two permanganate impinger contents were spiked for analysis of these samples and analysis indicated spike recoveries of 93.4 and 92.7 percent for these samples.

Matrix spikes performed on ash and lime slurry samples, as well as a reference spike sample prepared, did not fare as well. The spike level employed was too low for the ash spiked sample (MRI bar codes 04262 and 04263) while it appears as if the spiked lime slurry sample was not spiked at all for As, Cd, Cr or Pb, while spiked at a level 10 times higher for Hg. The reference spike for these samples indicated it may have been double spiked for Cd, Cr and Pb with 200 percent recovery for these analytes. Despite careful work, it appears that the spikes may have been confused during spiking.

IX. Additional Information

Raw data accompanies this report and is coded by Project Number 8910L and also contains a part number identifier as listed on 1357:23-24. With the exception of part numbers XLIX, L, LII, LIII and LIV, the photocopies of the notebook pages, this file contains the only record of the analysis. This file should therefore be archived as required by the project or as required by MRI policy.

This data has undergone one level of senior review within the Analytical Chemistry Section. The MRI Quality Assurance Unit has not reviewed this data.

Approved,

John Stanley, Head
Analytical Chemistry Section

Appendix ~~B~~ H-2 Metals Data

The Following are Deviations to the EPA SW-846 Methods Employed for analysis of metals:

Method 6010

Paragraph 5.4 Mixed Calibration Standard Solutions: MRI will use commercially available multielement standards, since use and preparation of individually prepared standards is not cost effective. These standard solutions will be prepared in 10 percent nitric acid or match the matrix of the samples.

Paragraph 5.5.1 The calibration blank will be prepared so as to contain 10 percent nitric acid to match the calibration standards in paragraph 5.4 or match the sample matrix.

Paragraph 5.7 The interference check solution is prepared to contain known concentrations of interfering elements that will provide an adequate test of the correction factors. Spike the sample with the elements of interest at a 1 mcg/mL level. In the absence of measurable analyte, overcorrection could go undetected because a negative value could be reported as zero. If the particular instrument will display overcorrection as a negative number, this spiking procedure will not be necessary.

Paragraph 5.8 The quality control sample(s) should be prepared in the same acid matix as the calibration standards at a 1 mcg/mL level from standards from an alternate lot than the calibration standards.

Paragraph 8.6.2.1 (addition) The expected value is defined to be the concentration obtained for the check standard analyzed subsequent to the calibration of the instrument.

Method 7060

Paragraph 2.1 Prior to analysis by Method 7060, samples must be prepared in order to convert organic forms of arsenic to inorganic forms, to minimize organic interferences, and to convert the sample to a siutable solution for analysis. Method 3050 may be employed for the preparation of aqueous or sludge samples. Aqueous samples may alternately be subjected to the acid digestion procedure described in this method. Other complete digestion methods, such as hydrofluoric acid digestates, may also be analyzed by this method.

Paragraph 2.2 Nickel nitrate (1000 mcg/mL, an experimentally predetermined volume) is added as a co-analyte by the GFAA autosampler to the graphite tube after sample addition but prior to the drying step.

Paragraph 3.2 Likewise, caution must be employed during the selection of temperature and times for the dry and char (ash) cycles. A nickel nitrate solution is added to the sample in the graphite tube furnace prior to the drying step to minimize volatilization losses during drying and ashing.

Paragraph 3.4 A clean-out step is programmed into the furnance to clean the tube after each analysis to assure complete volatilization of the analyte from the graphite tube furnace.

Paragraph 4.3 Atomic absorption spectrophotometer: A Perkin Elmer Zeeman 5000 (PE-5000) atomic absorption unit will be employed. Data output will be to a Perkin Elmer DS-10 Data Station. The PE-5000 cannot output data to a strip chart recorder and the Data Station simultaneously. Data from the Data Station will be used for calculations.

Paragraph 4.6 A Perkin Elmer DS-10 Data Station will be employed in the collection of data as described in paragraph 4.3.

Paragraph 5.4 Arsenic standard stock solution: Procure a certified aqueous standard from a supplier and verify by comparison with a second standard from a different lot, from the same or an alternate manufacturer.

Paragraph 5.5 Nickel nitrate solution (5%): A commercially prepared GFAA nickel nitrate (1000 mcg/mL) will be employed.

Paragraph 5.6 (comment) The nickel nitrate solution as described in paragraph 5.5 will be employed without dilution.

Paragraph 5.7 Arsenic working standards: Working standards will be prepared such that the final acid concentration (and matrix, if necessary) corresponds as closely as possible to that of the samples.

Paragraph 7.1 Aqueous and sludge-type samples can be prepared according to Method 3050. Aqueous samples can also be prepared in the manner describe in Paragraphs 7.1.1-7.1.3. The applicability of a sample-preparation technique to a new matrix must be demonstrated by analyzing spiked samples and/or relevenat standard reference materials.

Paragraph 7.6 Midpoint standards will be anlayzed at a frequency of 1 for every 10 samples. If the value obtained varies more than 20% from the corresponding standard in the calibration curve, the instrument will be recalibrated and all samples subsequent to an acceptible midpoint standard will be reanalyzed.

Paragraph 8.2 Calibration curves must be composed of a minimum of a blank and three standards. A midpoint check standard will be analyzed as per paragraph 7.6.

Para graph ~~8.5~~ A midpoint check standard will be analyzed to verify calibration as per paragraph 7.6.

Method 7421

Paragraph 4.1 Atomic absorption spectrophotometer: A Perkin Elmer Zeeman 5000 (PE-5000) atomic absorption unit will be employed. Data output will be to a Perkin Elmer DS-10 Data Station. The PE-5000 cannot output data to a strip chart recorder and the Data Station simultaneously. Data from the Data Station will be used for calculations.

Paragraph 5.2 Procure a certified aqueous standard from a supplier and verify by comparison with a second standard from a different lot, from the same or an alternate manufacturer.

Paragraph 5.3 Working standards will be prepared as calibration standards and will be prepared with a final acid concentration (and matrix, if necessary) which corresponds as closely as possible to that of the samples.

Paragraph 7.2 (addition) A midpoint standard will be analyzed as an instrument check standard to verify calibration after each 10 analyses.

Method 7470

Paragraph 1.1 (addition) This method may be used for the analysis of mercury in Method 3050 digestates as well as digestates from hydrofluoric acid digestions.

Paragraph 3.3 (revision of one sentence) In addition, the dead air space in the BOD bottle or MHS-10 cell must be purged before adding the stannous sulfate or chloride.

Paragraph 4.1 Atomic absorption spectrophotometer: A Perkin Elmer Zeeman 5000 atomic absorption spectrophotometer with an MHS-10 mercury vapor generation apparatus will be used. Alternately, a Perkin Elmer Model 3030B atomic absorption spectophotometer with an MHS-10 mercury vapor generation apparatus can be used.

Paragraphs 4.5, 4.6, 4.7 and 4.8 These pieces of apparatus are not employed with the use of the Perkin Elmer MHS-10.

Paragraph 4.9 The Perkin Elmer MHS-10 is assembled and employed according to the manufacturer's instructions.

Paragraph 5.9 Stock mercury solution: Procure a certified aqueous standard from a supplier. Prepare a 1 mcg/mL solution in 0.15% HNO_3 from this standard for preparation of the standards for the calibration curve.

Paragraph 7.1 Sample preparation: Transfer 50-g, or an aliquot possibly diluted to as much as approximately 50 mL, to a 250 mL glass stoppered Erlenmeyer flask. Add 5 mL of H2SO4 and 2.5 mL of concentrated HNO3, mixing after each addition. Add 20 mL of potassium permangante solution to each sample bottle. Sewage samples may require additional permanganate. Ensure that equal amounts of permangante are added to standards and blanks. Shake and add additional portions of potassium permanganate solution, if necessary, until the purple color prersists for at least 15 min. Add 8 mL of potassium persulfate to each bottle and heat for 2 hr in a water bath maintained at 95 C. Cool and add 6 mL of sodium chloride-hydroxylamine sulfate to reduce the excess permanganate. Dilute the sample to 250 mL in a volumetric flask and continue as described in Paragraph 7.3.

Paragraph 7.2 Standard Preparation: Transfer appropriate amounts of the 1 mcg/mL solution prepared in Paragraph 5.10 into 250 mL ground glass stoppered Erlenmeyer flasks for the calibration curve. Add enough Type II water to each flasks to make a total volume of approximately 50 mL. Mix thoroughly and add 5 mL of concentrated H2SO4 and 2.5 mL of concentrated HNO3 to each flask. Add 20 mL of KMnO4 solution to each flask and allow to stand at least 15 min. Add 8 mL of potassium persulfate to each bottle and heat for 2 hr in a water bath maintained at 95 C. Cool and add 6 mL sodium chloride-hydroxylamine sulfate soltuion to reduce the excess permanganate. Dilute the sample to 250 mL in a volumetric flask and continue as described in Paragraph 7.3.

Paragraph 7.3 Analysis: At this point the samples and standards are analyzed as per the manufacturer's recommendations for the Perkin Elmer MHS-10.

Paragraph 8.2 Calibration curves must be composed of a minimum of a blank and three standards. Instrument drift should be monitored by analyzing a standard at approximately the midpoint of the calibration curve after every 10 analyses.

Table 3. Raw Data for Project Sample Analysis.

Project No.: 891002-13
Lotus File: 0412
Data Analyst: N. Friederich
Date: 04-12-88
Analyte: (see below)

Ash & Lime Slurry Results + [illegible] 6-17-88

MRI Sample ID	Combined Barcode Contents	Sample Description	Arsenic Final Results	Cadmium Final Results	Chromium Final Results	Mercury Final Results	Lead Final Results
09168		Method Blank	-0.601	-0.131	-0.546	0.24	-3.34
09169		S 1033	30.3	30.5	390	7.96	2168
09170		BD 1033	34.1	30.8	377	22.6	2028
09171		S 1036	47.6	129	152	80.2	2767
09172		MS 1036	134	227	185	244	6011
09173		S 1042	7.24	-1.50	169	0.0640	417
09174		S 1046	4.95	-0.229	-0.955	-0.225	-5.85
09175		BD 1046	3.55	-0.224	-0.931	-0.223	-5.70
09176		MS 1046	16.1	8.98	5.975	19.0	19.8
09177		S 2033	32.7	35.2	438	5.00	2093
09178		S 2036	47.2	80.1	159	34.0	1285
09179		S 2042	14.0	2.73	312	1.22	585
09180		S 2046	2.20	-0.231	-0.960	-0.216	-5.88
09181		S NBS 1633a	127	-2.57	223	-0.264	124
09182		S 3033	38.9	38.1	424	13.4	2070
09183		S 3036	53.6	77.4	167	29.4	2128
09184		S 3046	4.19	-0.199	-0.830	0.419	-5.09
09185		Low Ref Spike	5.83	5.07	4.61	9.60	17.0
09186		Method Blank 2	0.826	-0.131	-0.546	-0.120	-3.34
09187		High Ref Spike	59.1	52.4	54.5	97.3	1836
04371	NA	1001	94.5	121	458	205	3943
dup04371			94.5	122	469	203	3961
04372	NA	1017	-2.58	-0.750	4.29	-3.16	15.4
dup04372			-2.58	-0.750	3.69	-3.19	15.9
04373	NA	2001	158	199	706	248	5816
04374	NA	2017	-2.58	-0.750	-1.28	-2.76	15.0
04375	NA	3001	70.2	89.4	566	54.6	3003
04376	NA	3017	-2.58	-0.750	-1.28	-3.18	7.12
04377	NA	11001/11005	-1.29	-0.375	-0.638	-1.52	0.790
04378	NA	16001	-1.29	-0.375	-0.638	-1.55	-0.440
04379	NA	18002	-1.29	-0.375	-0.638	1.78	2.64
04380	NA	HG/PB/CD/CR/AS FILT	294	249	249	-2.84	263
04381	NA	PB/CR/AS FILT 101	NA	NA	NA	NA	NA
04382	NA	PB/CR/AS FILT 102	NA	7.28	155	NA	498
04383	NA	CD AMPULE 103	NA	NA	NA	NA	NA
04384	NA	-CD AMPULE 104	NA	NA	NA	NA	NA
04385	NA	HF METHOD BLANK/ETSRC	-6.53	-14.6	-4.31	-10.5	-23.1
04386	04352/04362	1002/1003/1004/1005/1006	799	1770	3824	726	44417
dup04386			751	1716	3897	681	44472
04387	04353/04363	1018/1020/1021/1022	-9.03	12.7	-4.47	-9.55	204
dup04387			-9.03	11.7	-4.47	-10.3	203
04388	04354/04364	2002/2003/2004/2005/2006	1335	2770	6857	669	71517
04389	04355/04365	2018/2020/2021/2022	14.2	22.6	11.9	12.2	358
04390	04356/04366	3002/3003/3004/3005/3006	1140	2812	6795	753	61926

04391	04357/04367	3018/3020/3021/3022	7.52	30.6	11.7	13.6	360
04392	04358/04368	11004/11006	-3.87	1.14	-1.91	-40.7	1.68
04393	04359/04369	16002/16004/16005/16006	-7.74	-2.25	-3.83	-44.3	-2.64
04394	04360/04370	18001/18004/18005/18006	-6.45	3.42	-3.19	-71.0	17.8
04395	04361 blank		-1.29	-0.375	-0.638	-14.3	-0.440
Blank 2-17			-6.53	-0.278	-0.431	-1.61	-2.31
Blank 2-20			-1.29	-0.375	-0.638	-1.47	-1.60
Blank 2-22			-1.29	-0.278	-0.431	-1.52	-2.31
dupBL2-22			-6.53	NA	NA	-1.50	NA
Blank 2-23			-1.29	-0.278	-0.431	-1.49	-2.31
dupBL 2-23			-6.53	NA	NA	-1.68	NA
Blank 2-24			-6.33	-0.278	-0.431	-1.48	-2.31
09085	NA	Method Blank	-0.139	-0.241	-1.10	NA	0
09086	NA	S1007	1.52	4.27	2.04	NA	14.7
dup09086	NA	D1007	NA	4.20	1.72	NA	14.8
09087	NA	S1023	0.221	5.50	0.573	NA	3.67
09088	NA	S2007	6.41	23.3	3.87	NA	397
09089	NA	S2023	-0.140	2.02	-1.11	NA	2.87
09090	NA	S3007	1.02	5.07	-1.19	NA	13.1
09091	NA	S3023	0.309	1.01	-1.11	NA	7.01
09092	NA	S11007	-0.140	0.439	-1.11	NA	0.671
09093	NA	S16007	-0.141	0.329	-1.12	NA	3.82
09094	NA	S18007	-0.143	0.399	-1.13	NA	4.32
09095	NA	Spike	58.5	107	112	NA	103
04321	NA	S1007	NA	NA	NA	-0.00562	NA
04322	NA	S1008	NA	NA	NA	0.00121	NA
04323	NA	D1008	NA	NA	NA	0.00134	NA
04324	NA	S2007	NA	NA	NA	0.00650	NA
04325	NA	S2008	NA	NA	NA	0.00572	NA
04326	NA	MS2008	NA	NA	NA	0.02556	NA
04327	NA	S3007	NA	NA	NA	0.00662	NA
04328	NA	S3008	NA	NA	NA	0.00287	NA
04329	NA	S1023	NA	NA	NA	-0.00542	NA
04330	NA	S1024	NA	NA	NA	0.00077	NA
04331	NA	D1024	NA	NA	NA	0.00076	NA
04332	NA	S2023	NA	NA	NA	0.00078	NA
04333	NA	S2024	NA	NA	NA	0.00109	NA
04334	NA	S3023	NA	NA	NA	-0.00561	NA
04335	NA	S3024	NA	NA	NA	0.00121	NA
04336	NA	MS3024	NA	NA	NA	0.02033	NA
04337	NA	S11007	NA	NA	NA	0.00629	NA
04338	NA	S11008	NA	NA	NA	-0.00049	NA
04339	NA	S16007	NA	NA	NA	-0.00520	NA
04340	NA	S16008	NA	NA	NA	-0.00049	NA
04341	NA	S18007	NA	NA	NA	0.00658	NA
04342	NA	S18008	NA	NA	NA	-0.00050	NA

NA = Not Applicable or Not Analyzed

A negative in this table indicates that the sample was less than the detection limit.

Table 4. Final Sample Results for Project 8910L.

Project No.: 891002-13
Lotus File: 0412
Data Analyst: N. Friederich

Date: 04-12-88
Analyte: (see below)
Units: (see below)

BLANK CORRECTED VALUES
↓

Lime Slurry & Ash Results

Verified by: R.L. McClendon 6-17-88

MRI Sample ID	Combined Barcode Contents	Sample Description	Arsenic Final Results	Cadmium Final Results	Chromium Final Results	Mercury Final Results	Lead Final Results
* 09169	NA	Cyclone ash 1033	32.2	30.7	383	15.3	2100 *
09171	NA	Ash - Baghouse 1036	47.6	129	152	80.2	2770
09173	NA	Bottom Ash 1042	7.24	<1.50	169	0.0640	417
* 09174	NA	Lime Slurry 1046	4.25	<0.226	<0.943	<0.224	<5.78 *
09177	NA	Cyclone ash 2033	32.7	35.2	438	5.00	2090
09178	NA	Baghouse Ash 2036	47.2	80.1	159	34.0	1290
09179	NA	Bottom Ash 2042	14.0	2.73	312	1.22	585
09180	NA	Lime Slurry 2046	2.20	<0.231	<0.960	<0.216	<5.86
09182	NA	Cyclone 3033	38.9	38.1	424	13.4	2070
09183	NA	Baghouse 3036	53.6	77.4	167	29.4	2130
09184	NA	Lime Slurry 3046	4.19	<0.199	<0.830	0.419	<5.09
* 04371	NA	1001	94.5	122	464	204	3950 *
* 04372	NA	1017	<2.58	<0.750	3.99	<3.16	15.7 *
04373	NA	2001	158	199	706	248	5820
04374	NA	2017	<2.58	<0.750	<1.28	<2.76	15.0
04375	NA	3001	70.2	89.4	568	54.6	3000
04376	NA	3017	<2.58	<0.750	<1.28	<3.18	7.12
04377	NA	11001/11005	<1.29	<0.375	<0.638	<1.52	0.790
04378	NA	16001	<1.29	<0.375	<0.638	<1.55	<0.440
04379	NA	18002	<1.29	<0.375	<0.638	1.78	2.64
ug * 04386	04352/04362	1002/1003/1004/1005/1006	775	1740	3860	703	44400 *
* 04387	04353/04363	1018/1020/1021/1022	<9.03	12.2	<4.47	<10.3	204 *
04388	04354/04364	2002/2003/2004/2005/2006	1330	2770	6860	669	71500
04389	04355/04365	2018/2020/2021/2022	14.2	22.6	11.9	12.2	358
04390	04356/04366	3002/3003/3004/3005/3006	1140	2810	6800	753	61900
04391	04357/04367	3018/3020/3021/3022	7.52	30.6	11.7	13.6	360
04392	04358/04368	11004/11006	<3.87	1.14	<1.91	<40.7	1.68
04393	04359/04369	16002/16004/16005/16006	<7.74	<2.25	<3.83	<44.3	<2.64
04394	04360/04370	18001/18004/18005/18006	<6.45	3.42	<3.19	<71.0	17.8
* 09086	NA	1007	1.52	4.24	1.88	NA	14.8 * Except As
09087	NA	1023	0.221	5.50	0.573	NA	3.67
09088	NA	2007	6.41	23.3	3.87	NA	397
09089	NA	2023	<0.140	2.02	<1.11	NA	2.87
09090	NA	3007	1.02	5.07	<1.19	NA	13.1
09091	NA	3023	0.309	1.01	<1.11	NA	7.01
09092	NA	11007	<0.140	0.439	<1.11	NA	0.671
09093	NA	16007	<0.141	0.329	<1.12	NA	3.82
09094	NA	18007	<0.143	0.399	<1.13	NA	4.32
04321	NA	1007	NA	NA	NA	<0.00562	NA
* 04322	NA	1008	NA	NA	NA	0.00128	NA
04324	NA	2007	NA	NA	NA	0.00650	NA
04325	NA	2008	NA	NA	NA	0.00572	NA
04327	NA	3007	NA	NA	NA	0.00682	NA
04328	NA	3008	NA	NA	NA	0.00287	NA
04329	NA	1023	NA	NA	NA	<0.00542	NA
* 04330	NA	1024	NA	NA	NA	0.000764	NA
04332	NA	2023	NA	NA	NA	0.00078	NA

04333	NA	2024	NA	NA	NA	0.00109	NA
04334	NA	3023	NA	NA	NA	<0.00561	NA
04335	NA	3024	NA	NA	NA	0.00121	NA
04337	NA	11007	NA	NA	NA	0.00629	NA
04338	NA	11006	NA	NA	NA	<0.000487	NA
04339	NA	16007	NA	NA	NA	<0.00520	NA
04340	NA	16008	NA	NA	NA	<0.000490	NA
04341	NA	18007	NA	NA	NA	0.00658	NA
04342	NA	18008	NA	NA	NA	<0.000502	NA

Aliquots of MRI Samples 09086 through 09094, the impinger contents, were removed for mercury analysis prior to preparation for the other analyses. The calculations are not adjusted for the fraction of the samples removed for the mercury.

* These results are averages of either duplicate analyses or averages of samples prepared and analyzed in duplicate. The result for arsenic for MRI Sample 09086 was from a single analysis.

NA = Not Analyzed or Not Applicable

These samples were analyzed on a Jarrell-Ash Model 1155A ICP-AES, a Perkin-Elmer Model 5000 atomic absorption spectrometer and a Perkin-Elmer Model 3030B atomic absorption spectrometer. The atomic absorption spectrometers were equipped with an MHS-10 cold vapor generator, lead hollow cathode lamp and arsenic and mercury electrodeless discharge lamps.

Table 8. Pb GFAA Analysis Raw Data 3-31-88

Project No.: 8910L02-13
Lotus File: 0412B
Data Analyst: N. Friederich
Date: 04-13-88
Analyte: Pb

GFAA Data File: 331A
Analyst: E McClendon
Date: 03-31-88

Sample Analysis Data:
Instrumental Detection Limit: (ug/L, see below)
Verified by: M Green 4/14/88 Calculation by E.L. McClendon 4-15-88

Std or ASF Bar Code	Absorbance
0 ug/L	0
5 ug/L	0.013
10 ug/L	0.024
25 ug/L	0.061
50 ug/L	0.119
100 ug/L	0.216

Regression Output:

Constant		0.0035725806
Std Err of Y Est		0.0048785657
R Squared		0.9972028183
No. of Observations		6
Degrees of Freedom		4
X Coefficient(s)	0.002166129	
Std Err of Coef.	0.0000573618	
Correlation Coefficient		0.9986004298

ASF Bar Code	Absorbance	Dilution Factor	Result (ug/L)	X DF (ug/mL)
NBS1643b	0.031	2	12.6620	0.0253
50 ug/L	0.119	1	53.2874	0.0533
MRIS				
blank 2-20	0.002	10	-0.8759	-0.0088
blank 2-22	0.002	10	-0.8759	-0.0088
Blank 2-23	0.002	10	-0.8759	-0.0088
04259	0.008	10	2.0439	0.0204
04372	0.037	10	15.4319	0.1543
04372	0.038	10	15.8935	0.1589
04374	0.036	10	14.9702	0.1497
04376	0.019	10	7.1221	0.0712
04377	0.007	10	1.5823	0.0158
04378	0.005	10	-0.8759	-0.0088
04379	0.015	10	5.2755	0.0528
04392	0.006	10	1.1206	0.0112
04393	0.004	10	-0.8759	-0.0088
04394	0.019	10	7.1221	0.0712
04395	0.000	10	-0.8759	-0.0088
04265	0.004	10	-0.8759	-0.0088
04266	0.010	10	2.9672	0.0297
04267	0.001	10	-0.8759	-0.0088
04271	0.002	10	-0.8759	-0.0088
04275	0.003	10	-0.8759	-0.0088

04272	0.108	20	48.2092	0.9642

Detection Limit Determination:

5 ug/L	0.013
5 ug/L	0.014
5 ug/L	0.014
5 ug/L	0.014
5 ug/L	0.015

Detection Limit (ug/L) =
3X Standard Deviation Limit/Slope of Curve =
0.676 ug/L

A negative number indicates that the sample was less than the detection limit.

Table 9. As GFAA Analysis Raw Data 4-1-88

Project No.: 8910L02-13
Lotus File: 0412B
Data Analyst: N. Friederich
Date: 04-13-88
Analyte: As

GFAA Data File: 401A
Analyst: E McClendon
Date: 04-01-88

Sample Analysis Data:
Instrumental Detection Limit: (ug/L, see below)
Verified by: M Shera 4/14/88

Calculations by E McClendon 4-15-88

Std or ASF Bar Code	Absorbance
0 ug/L	0.002
5 ug/L	0.014
10 ug/L	0.020
25 ug/L	0.050
50 ug/L	0.100
100 ug/L	0.197
250 ug/L	0.467

Regression Output:

Constant		0.0043983366
Std Err of Y Est		0.0037811354
R Squared		0.9995713915
No. of Observations		7
Degrees of Freedom		5
X Coefficient(s)	0.0018618446	
Std Err of Coef.	0.0000172418	
Correlation Coefficient		0.9997856728

ASF Bar Code	Absorbance	Dilution Factor	Result (ug/L)	Result X DF (ug/mL)
NBS 1643b	0.055	2	27.1782	0.0544
100 ug/L MRI6A	0.211	1	110.9661	0.1110
Blank 2-20	0.001	10	-2.5781	-0.0258
Blank 2-22	0.001	10	-2.5781	-0.0258
Blank 2-23	0.003	10	-2.5781	-0.0258
04259	0.003	10	-2.5781	-0.0258
04372	0.002	10	-2.5781	-0.0258
dup04372	0.002	10	-2.5781	-0.0256
04374	0.003	10	-2.5781	-0.0258
04376	0.003	10	-2.5781	-0.0258
04377	0.004	10	-2.5781	-0.0258
04378	0.002	10	-2.5781	-0.0256
04379	0.001	10	-2.5781	-0.0258
04387	0.007	10	-2.5781	-0.0258
dup04387	0.008	10	-2.5781	-0.0258
04389	0.015	10	5.6942	0.0569
04391	0.010	10	3.0087	0.0301
04392	0.008	10	-2.5781	-0.0258
04393	0.005	10	-2.5781	-0.0258
04394	0.006	10	-2.5781	-0.0258
04395	0.004	10	-2.5781	-0.0258
04265	0.021	10	8.9168	0.0892

04266	0.018	10	7.3055	0.0731
04267	0.018	10	7.3055	0.0731
04271	0.012	10	4.0829	0.0408
04275	0.019	10	7.8426	0.0784
04380	0.278	20	146.9519	2.9390

Detection Limit Determination:

5 ug/L	0.020
5 ug/L	0.020
5 ug/L	0.018
5 ug/L	0.017
5 ug/L	0.016

Detection Limit (ug/L) =
3X Standard Deviation Limit/Slope of Curve =
2.578 ug/L

A negative number indicates that the sample was less than the detection limit.

Table 10. As GFAA Analysis Raw Data 4-4-88

Project No.: 8910L02-13
Lotus File: 0412B
Data Analyst: N. Friederich
Date: 04-13-88
Analyte: As

GFAA Data File: 404A
Analyst: E McClendon
Date: 04-04-88

Sample Analysis Data:
Instrumental Detection Limit: (ug/L, see below)
Verified by: M 4/15/88 Calculations by ESMcClendon 4-15-88

Std or ASF Bar Code		Absorbance
0	ug/L	-0.001
5	ug/L	0.010
10	ug/L	0.020
25	ug/L	0.051
50	ug/L	0.105
100	ug/L	0.211
250	ug/L	0.512

Regression Output:

Constant		0.000582207
Std Err of Y Est		0.0027499835
R Squared		0.9998137443
No. of Observations		7
Degrees of Freedom		5
X Coefficient(s)	0.002054374	
Std Err of Coef.	0.0000125398	
Correlation Coefficient		0.9999068678

ASF Bar Code	Absorbance	Dilution Factor	Result (ug/L)	Result X DF (ug/mL)
NBS 1643b	0.136	1	65.9168	0.0659
100 ug/L MRI6A	0.224	1	108.7523	0.1088
Blank 2-17	-0.002	100	-1.3061	-0.1306
Blank 2-22	-0.001	100	-1.3061	-0.1306
Blank 2-23	-0.001	100	-1.3061	-0.1306
Blank 2-24	-0.001	100	-1.3061	-0.1306
04385	-0.002	100	-1.3061	-0.1306
04259	-0.001	100	-1.3061	-0.1306
09085	0.000	1	-1.3061	-0.0013
04386	0.017	100	7.9916	0.7992
dup04386	0.016	100	7.5049	0.7505
04388	0.028	100	13.3461	1.3346
04390	0.024	100	11.3990	1.1399
04371	0.020	100	9.4519	0.9452
dup04371	0.020	100	9.4519	0.9452
04373	0.033	100	15.7799	1.5780
04375	0.015	100	7.0181	0.7018
04260	0.010	100	4.5843	0.4584
04261	0.008	100	3.6107	0.3611
04262	0.015	100	7.0181	0.7018

04263	0.015	100	7.0181	0.7018
04264	0.024	100	11.3990	1.1399
04268	0.010	100	4.5843	0.4584
04269	0.010	100	4.5843	0.4584
04270	0.051	100	24.5417	2.4542
04272	0.041	100	19.6740	1.9674
04273	0.010	100	4.5843	0.4584
04274	0.015	100	7.0181	0.7018
09086	0.032	1	15.2931	0.0153
09087	0.005	1	2.1504	0.0022
09088	0.132	1	63.9698	0.0640
09089	0.001	1	-1.3061	-0.0013
09090	0.020	1	9.4519	0.0095
09091	0.007	1	3.1240	0.0031
09092	0.001	1	-1.3061	-0.0013
09093	0.001	1	-1.3061	-0.0013
09094	-0.001	1	-1.3061	-0.0013
09095	0.302	4	146.7200	0.5869

Detection Limit Determination:

5 ug/L	0.012
5 ug/L	0.011
5 ug/L	0.013
5 ug/L	0.013
5 ug/L	0.011

Detection Limit (ug/L) =
3X Standard Deviation Limit/Slope of Curve =
1.306 ug/L

A negative number indicates that the sample was less than the detection limit.

Table 11. Pb GFAA Analysis Raw Data 4-8-88

Project No.: B910L02-13	GFAA Data File: 408A
Lotus File: 0412B	Analyst: E McClendon
Data Analyst: N. Friederich	Date: 04-08-88
Date: 04-13-88	
Analyte: Pb	

Sample Analysis Data:
Instrumental Detection Limit: (ug/L, see below)
Verified by: 4/15/88 Calculations by Ed McClendon 4-15-88

Std or ASF Bar Code		Absorbance
0	ug/L	0.001
5	ug/L	0.008
10	ug/L	0.032
25	ug/L	0.084
50	ug/L	0.147
100	ug/L	0.280

Regression Output:

Constant		0.0029976959
Std Err of Ŷ Est		0.0075914547
R Squared		0.9959818592
No. of Observations		6
Degrees of Freedom		4
X Coefficient(s)	0.0028105991	
Std Err of Coef.	0.0000892598	
Correlation Coefficient		0.9979889074

ASF Bar Code	Absorbance	Dilution Factor	Result (ug/L)	X DF (ug/mL)
NBS 1643b	0.070	1	23.8392	0.0238
50 ug/L MRIS	0.144	1	50.1681	0.0502
09085	0.040	1	13.1653	0.0132
09086	0.230	2	80.7665	0.1615
dup09086	0.231	2	81.1223	0.1622
09067	0.143	1	49.8123	0.0498
09089	0.121	1	41.9848	0.0420
09090	0.193	2	67.6021	0.1352
09091	0.238	1	83.6129	0.0836
09092	0.059	1	19.9254	0.0199
09093	0.147	1	51.2354	0.0512
09094	0.159	1	55.5050	0.0555

Detection Limit Determination:

5 ug/L	0.010
5 ug/L	0.007
5 ug/L	0.007
5 ug/L	0.010
5 ug/L	0.006

Detection Limit (ug/L) =
3X Standard Deviation Limit/Slope of Curve =
1.786 ug/L

A negative number indicates that the sample was less than the detection limit.

Table 12. Hg CVAAS Analysis Raw Data 1-7-88

Project No.: 8910L02-13
Lotus File: 0422
Data Analyst: N. Friederich
Date: 04-22-88
Analyte: Hg

CVAAS Data File: KMN.DF
Analyst: N. Freiderich
Date: 01-07-88

Sample Analysis Data:
Instrumental Detection Limit: (ug, see below)
Verified by: EHMcClendon 5-6-88

Std or ASF Bar Code	Absorbance
0.000 ug/50mL Aliquot	0.000
0.005 ug/50mL Aliquot	0.003
0.010 ug/50mL Aliquot	0.006
0.020 ug/50mL Aliquot	0.011
0.050 ug/50mL Aliquot	0.029
0.100 ug/50mL Aliquot	0.060
0.250 ug/50mL Aliquot	0.144
0.500 ug/50mL Aliquot	0.286
0.750 ug/50mL Aliquot	0.464
1.000 ug/50mL Aliquot	0.577

Regression Output:

Constant	-0.0001675795
Std Err of Y Est	0.0095111067
R Squared	0.9982163017
No. of Observations	10
Degrees of Freedom	8
X Coefficient(s)	0.5890785085
Std Err of Coef.	0.0088039295
Correlation Coefficient	0.9991077528

ASF Bar Code	Absorbance	Dilution Factor	Result (ug)	Initial Sample Wt. (g)	X DF (ug/mL)
04321	0.001	1	-0.0057	5.0698	-0.005615
04322	0.008	1	0.0139	57.2494	0.001211
04323	0.009	1	0.0156	58.0655	0.001340
04324	0.004	1	0.0071	5.4404	0.006502
04325	0.037	1	0.0631	55.1929	0.005716
04326	0.177	1	0.3008	58.8262	0.025563
04327	0.004	1	0.0071	5.1899	0.006816
04328	0.020	1	0.0342	59.6182	0.002871
04329	0.002	1	-0.0057	5.2517	-0.005421
04330	0.005	1	0.0088	57.0530	0.000769
04331	0.005	1	0.0088	57.8407	0.000758
04332	0.005	1	0.0088	56.1200	0.000782
04333	0.007	1	0.0122	56.0293	0.001086
04334	0.002	1	-0.0057	5.0744	-0.005610
04335	0.008	1	0.0139	57.3545	0.001209
04336	0.145	1	0.2464	60.6080	0.020330
04337	0.004	1	0.0071	5.6264	0.006287
04338	0.002	1	-0.0057	58.5067	-0.000487
04339	0.001	1	-0.0057	5.4732	-0.005202
04340	0.002	1	-0.0057	58.0626	-0.000490
04341	0.004	1	0.0071	5.3740	0.006582
04342	0.002	1	-0.0057	56.6692	-0.000502

```
Detection Limit Determination:

        04325          0.037            Detection Limit (ug/50mL Aliquot) =
        04325          0.035            3X Standard Deviation Limit/Slope of Curve =
        04325          0.036                   0.006 ug
        04325          0.034

--------------------------------------------------------------------------------
A negative value indicates that the sample was less than the detection limit.
```

Table 13. Hg CVAAS Analysis Raw Data 4-9-88

Project No.: 8910L02-13
Lotus File: 0422
Data Analyst: E. McClendon
Date: 5-4-88
Analyte: Hg

CVAAS Data File: 0409
Analyst: N. Freiderich
Date: 4-9-88

Sample Analysis Data:
Instrumental Detection Limit: (ug. see below)
Verified by: EWMcClendon 5-6-88

Std or ASF Bar Code	Absorbance
0.000 ug/50mL Aliquot	0.012
0.005 ug/50mL Aliquot	0.006
0.010 ug/50mL Aliquot	0.010
0.020 ug/50mL Aliquot	0.010
0.050 ug/50mL Aliquot	0.022
0.100 ug/50mL Aliquot	0.050
0.250 ug/50mL Aliquot	0.099
0.500 ug/50mL Aliquot	0.250
0.750 ug/50mL Aliquot	0.357
1.000 ug/50mL Aliquot	0.470

Regression Output:

Constant		0.0023818045
Std Err of Y Est		0.0095306974
R Squared		0.9971903446
No. of Observations		10
Degrees of Freedom		8
X Coefficient(s)	0.4700863892	
Std Err of Coef.	0.0068220635	
Correlation Coefficient		0.9985941841

ASF Bar Code	Absorbance	Dilution Factor	Result (ug)	Initial Sample Wt. (g)	X DF (ug/mL)
Blank 2-20	0.008	1	-0.0627	10.6280	-0.0295
Blank 2-22	0.006	1	-0.0627	10.2841	-0.0305
Blank 2-23	0.010	1	-0.0627	10.5254	-0.0298
Ref Spk	0.030	1	-0.0627	9.6499	-0.0325
04259	0.005	1	-0.0627	11.6618	-0.0269
04265	0.004	1	-0.0627	11.2834	-0.0278
04266	0.004	1	-0.0627	10.6803	-0.0293
04271	0.004	1	-0.0627	9.5415	-0.0329
04275	0.004	1	-0.0627	10.352	-0.0303
04372	0.006	1	-0.0627	9.9107	-0.0316
04372 dup	0.007	1	-0.0627	9.8182	-0.0319
04374	0.007	1	-0.0627	11.3569	-0.0276
04376	0.007	1	-0.0627	9.8487	-0.0318
04377	0.006	1	-0.0627	10.2880	-0.0305
04378	0.008	1	-0.0627	10.0875	-0.0311
04380	0.017	1	-0.0627	11.0515	-0.0284
04387	0.028	1	-0.0627	11.4852	-0.0273
04387 dup	0.030	1	-0.0627	10.6351	-0.0295
04389	0.050	1	0.1013	10.3605	0.0489
04391	0.055	1	0.1119	10.2532	0.0546
04392	0.040	1	0.0800	10.4184	0.0384
04393	0.034	1	0.0673	10.9371	0.0307
04394	0.035	1	0.0694	10.0403	0.0346
04395	0.036	1	0.0715	10.2363	0.0349

04379	0.036	1	0.0715	10.0677	0.0355

Detection Limit Determination:

04387 dup	0.030
04387 dup	0.052
04387 dup	0.053
04387 dup	0.053

Detection Limit (ug/50mL Aliquot) =
3X Standard Deviation Limit/Slope of Curve =
0.063 ug

A negative value indicates that the sample was less than the detection limit.

Table 14. Hg CVAAS Analysis Raw Data 4-13-88

Project No.: 8910L02-13
Lotus File: 0422
Data Analyst: E. McClendon
Date: 5-4-88
Analyte: Hg

CVAAS Data File: Not Applicable
Analyst: D. Blevins/S. Schroeder
Date: 4-13-88

Sample Analysis Data:
Instrumental Detection Limit: (ug. see below)
Verified by: HSMcClendon 5-6-88

Std or ASF Bar Code	Absorbance
0.000 ug/50mL Aliquot	0.002
0.020 ug/50mL Aliquot	0.006
0.050 ug/50mL Aliquot	0.024
0.100 ug/50mL Aliquot	0.042
0.250 ug/50mL Aliquot	0.114
0.500 ug/50mL Aliquot	0.254
0.750 ug/50mL Aliquot	0.368
1.000 ug/50mL Aliquot	0.439

Regression Output:

Constant		0.0023843723
Std Err of Y Est		0.0159360384
R Squared		0.9928475109
No. of Observations		8
Degrees of Freedom		6
X Coefficient(s)	0.4606460755	
Std Err of Coef.	0.0159616975	
Correlation Coefficient		0.9964173377

ASF Bar Code	Absorbance	Dilution Factor	Result (ug)	Initial Sample Wt. (g)	X DF (ug/mL)
Blank 2-17	0.000	1	-0.0640	9.9536	-0.0321
Blank 2-22	0.000	1	-0.0640	10.6433	-0.0301
Blank 2-23	0.000	1	-0.0640	9.5340	-0.0336
Blank 2-24	0.000	1	-0.0640	10.7852	-0.0297
04259	0.000	1	-0.0640	6.0078	-0.0532
04260	0.002	1	-0.0640	1.0136	-0.3156
04261	0.002	1	-0.0640	1.3399	-0.2387
04262	0.035	1	0.0708	0.5473	0.6468
04263	0.053	1	0.1099	0.4776	1.1503
04264	0.000	1	-0.0640	1.2721	-0.2515

Detection Limit Determination:

04387 dup	0.030
04387 dup	0.052
04387 dup	0.053
04387 dup	0.053

Detection Limit (ug/50mL Aliquot) =
3X Standard Deviation Limit/Slope of Curve =
0.064 ug

A negative value indicates that the sample was less than the detection limit.

Table 15. Hg CVAAS Analysis Raw Data 4-14-88

Project No.: 8910L02-13
Lotus File: 0422
Data Analyst: E. McClendon
Date: 5-4-88
Analyte: Hg

CVAAS Data File: 0414
Analyst: D. Blevins
Date: 4-14-88

Sample Analysis Data:
Instrumental Detection Limit: (ug. see below)
Verified by: EdMcClendon 5-6-88

Std or ASF Bar Code	Absorbance
0.000 ug/50mL Aliquot	-0.004
0.020 ug/50mL Aliquot	-0.001
0.050 ug/50mL Aliquot	0.018
0.100 ug/50mL Aliquot	0.038
0.250 ug/50mL Aliquot	0.102
0.500 ug/50mL Aliquot	0.234
0.750 ug/50mL Aliquot	0.349
1.000 ug/50mL Aliquot	0.464

Regression Output:

Constant		-0.0081816711
Std Err of Y Est		0.0047008174
R Squared		0.9994082087
No. of Observations		8
Degrees of Freedom		6
X Coefficient(s)	0.4739525726	
Std Err of Coef.	0.0047083864	
Correlation Coefficient		0.9997040606

ASF Bar Code	Absorbance	Dilution Factor	Result (ug)	Initial Sample Wt. (g)	X DF (ug/mL)
04269	-0.015	1	-0.0622	1.0593	-0.2935
04385	-0.020	1	-0.0622	1.4874	-0.2090
04386	0.065	1	0.1544	1.0640	0.7256
04386 dup	0.062	1	0.1481	1.0866	0.6814
04388	0.059	1	0.1417	1.0592	0.6691
04390	0.071	1	0.1671	1.1098	0.7527
04268	-0.013	1	-0.0622	1.1294	-0.2755
04270	-0.015	1	-0.0622	1.4385	-0.2161
04272	-0.019	1	-0.0622	1.2142	-0.2561
04273	-0.007	1	-0.0622	1.1218	-0.2771
04274	0.016	1	-0.0622	1.0289	-0.3022
04375	0.043	1	0.1080	0.9895	0.5457
04392	-0.021	1	-0.0622	1.1458	-0.2713
04393	-0.021	1	-0.0622	2.1055	-0.1477
04394	-0.022	1	-0.0622	1.0954	-0.2838
04395	-0.021	1	-0.0622	1.0857	-0.2864

Detection Limit Determination:

04387 dup	0.030
04387 dup	0.052
04387 dup	0.053
04387 dup	0.053

Detection Limit (ug/50mL Aliquot) =
3X Standard Deviation Limit/Slope of Curve =
0.062 ug

A negative value indicates that the sample was less than the detection limit.

Table 16. As GFAA Analysis Raw Data 6-6-88

Project No.: 89:0L02-13
Lotus File: 0412B
Data Analyst: E. McClendon
Date: 6-14-88
Analyte: As

GFAA Data File: 606A
Analyst: E. McClendon
Date: 6-6-88

Sample Analysis Data:
Instrumental Detection Limit: (ug/L, see below)
Verified by: E McClendon 6-14-88

Std or ASF Bar Code		Absorbance
0	ug/L	-0.002 ✓
5	ug/L	0.009 ✓
10	ug/L	0.018 ✓
25	ug/L	0.050 ✓
50	ug/L	0.098 ✓
100	ug/L	0.199 ✓
250	ug/L	0.498 ✓

Regression Output:

Constant		-0.0013025397 ✓
Std Err of Y Est		0.0008391593
R Squared		0.9999816608
No. of Observations		7
Degrees of Freedom		5
X Coefficient(s)	0.001997995 ✓	
Std Err of Coef.	0.0000038265	
Correlation Coefficient		0.9999908303 ✓

ASF Bar Code	Sample Description	Absorbance	Dilution Factor	Result (ug/L)	X DF (ug/mL)	Blank Corrected (ug/mL)
NBS1643b		0.062 ✓	2	31.6830 ✓	0.0634 ✓	
100 ug/L		0.106 ✓	2	53.7051 ✓	0.1074 ✓	
MRI2A						
09168	Method Blank	0.001 ✓	10	-1.2012 ✓	-0.0120 ✓	
09169	S 1066	0.060 ✓	10	30.6820 ✓	0.3068 ✓	
09170	BD 1066	0.067 ✓	10	34.1855 ✓	0.3419 ✓	
09171	S 1036	0.095 ✓	10	48.1996 ✓	0.4820 ✓	
09172	MS 1036	0.271 ✓	10	136.2879 ✓	1.3629 ✓	
09173	S 1042	0.024 ✓	10	12.6640 ✓	0.1266 ✓	
09174	S 1046	0.010 ✓	10	5.6569 ✓	0.0566 ✓	
09175	BD 1046	0.007 ✓	10	4.1554 ✓	0.0416 ✓	
09176	MS 1046	0.032 ✓	10	16.6680 ✓	0.1667 ✓	
09177	S 2033	0.065 ✓	10	33.1845 ✓	0.3318 ✓	
09178	S 2036	0.097 ✓	10	49.2006 ✓	0.4920 ✓	0.4755 ✓
09179	S 2042	0.030 ✓	10	15.6670 ✓	0.1567 ✓	0.1401 ✓
09180	S 2046	0.007 ✓	10	4.1554 ✓	0.0416 ✓	0.0250 ✓
09181	S NBS 1633a	0.260 ✓	10	130.7824 ✓	1.3078 ✓	1.2913 ✓
09182	S 3033	0.081 ✓	10	41.1926 ✓	0.4119 ✓	0.3954 ✓
09183	S 3036	0.111 ✓	10	56.2076 ✓	0.5621 ✓	0.5455 ✓
09184	S 3046	0.013 ✓	10	7.1584 ✓	0.0716 ✓	0.0551 ✓
09185	Low Ref Spike	0.022 ✓	10	11.6630 ✓	0.1166 ✓	
09186	Method Blank 2	0.002 ✓	10	1.6529 ✓	0.0165 ✓	
09187	High Ref Spike	0.235 ✓	10	118.2698 ✓	1.1827 ✓	

Detection Limit Determination:

5 ug/L	0.014 ✓	Detection Limit (ug/L) =
5 ug/L	0.015 ✓	3X Standard Deviation Limit/Slope of Curve =
5 ug/L	0.013 ✓	1.20 ✓ ug/L
5 ug/L	0.013 ✓	
5 ug/L	0.013 ✓	

Drift Calculations (100 ug/L standard):

		% Drift
Initial ICS	0.199 ✓	
ICS1	0.204 ✓	2.51 ✓
ICS2	0.215 ✓	8.04 ✓
ICS3	0.227 ✓	14.07 ✓

A negative number indicates that the sample was less than the detection limit.

Table 17. Pb GFAA Analysis Raw Data 6-6-88

Project No.: 8910L02-13
Lotus File: 0412B
Data Analyst: E. McClendon
Date: 6-14-88
Analyte: As

GFAA Data File: 606B
Analyst: E. McClendon
Date: 6-6-88

Sample Analysis Data:
Instrumental Detection Limit: (ug/L, see below)
Verified by: E McClendon 6-14-88

Std or ASF Bar Code		Absorbance
0	ug/L	0.004 ✓
5	ug/L	0.030 ✓
10	ug/L	0.048 ✓
25	ug/L	0.119 ✓
50	ug/L	0.229 ✓
100	ug/L	0.422 ✓

Regression Output:

Constant		0.0094596774 ✓
Std Err of Y Est		0.007184633
R Squared		0.9983732071
No. of Observations		6
Degrees of Freedom		4
X Coefficient(s)	0.0041854839 ✓	
Std Err of Coef.	0.0000844764	
Correlation Coefficient		0.9991862725 ✓

ASF Bar Code	Sample Description	Absorbance	Dilution Factor	Result (ug/L)	X DF (ug/mL)	Blank Corrected (ug/mL)
NBS1643b		0.061 ✓	2	12.3141 ✓	0.0246 ✓	
100 ug/L		0.225 ✓	2	51.4971 ✓	0.1030 ✓	
MRI2A						
09168	Method Blank	0.005 ✓	10	-6.6840 ✓	-0.0668 ✓	
09174	S 1046	0.003 ✓	10	-6.6840 ✓	-0.0668 ✓	
09175	BD 1046	0.002 ✓	10	-6.6840 ✓	-0.0668 ✓	
09176	MS 1046	0.095 ✓	10	20.4374 ✓	0.2044 ✓	
09180	S 2046	0.002 ✓	10	-6.6840 ✓	-0.0668 ✓	
09184	S 3046	0.002 ✓	10	-6.6840 ✓	-0.0668 ✓	
09185	Low Ref Spike	0.152 ✓	10	34.0559 ✓	0.3406 ✓	
09186	Method Blank 2	0.000 ✓	10	-6.6840 ✓	-0.0668 ✓	

Detection Limit Determination:

5 ug/L	0.034 ✓
5 ug/L	0.038 ✓
5 ug/L	0.057 ✓
5 ug/L	0.033 ✓
5 ug/L	0.032 ✓

Detection Limit (ug/L) =
3X Standard Deviation Limit/Slope of Curve =
6.68 ✓ ug/L

Drift Calculations (50 ug/L standard):

		% Drift
Initial ICS	0.229 ✓	

ICS1	0.231 ✓	0.87 ✓
ICS2	0.232 ✓	1.31 ✓

A negative number indicates that the sample was less than the detection limit.

Table 18. Hg CVAAS Analysis Raw Data 6-7-88

Project No.: 8910L02-13
Lotus File: 0422
Data Analyst: E. McClendon
Date: 6-13-88
Analyte: Hg

CVAAS Data File: 0607
Analyst: N. Friederich
Date: 6-7-88

Sample Analysis Data:
Instrumental Detection Limit: (ug. see below)
Verified by: EdJ McClendon 6-14-88

Std or ASF Bar Code	Absorbance
0.000 ug/50mL Aliquot	0.000 ✓
0.020 ug/50mL Aliquot	0.009 ✓
0.050 ug/50mL Aliquot	0.027 ✓
0.100 ug/50mL Aliquot	0.057 ✓
0.250 ug/50mL Aliquot	0.133 ✓
0.500 ug/50mL Aliquot	0.256 ✓
0.750 ug/50mL Aliquot	0.408 ✓
1.000 ug/50mL Aliquot	0.534 ✓

Regression Output:

Constant		-0.000535721 ✓
Std Err of Y Est		0.0056583039
R Squared		0.9993269906
No. of Observations		8
Degrees of Freedom		6
X Coefficient(s)	0.5349384899 ✓	
Std Err of Coef.	0.0056674145	
Correlation Coefficient		0.9996634387 ✓

ASF Bar Code	Sample Description	Absorbance	Dilution Factor	Result (ug)	Initial Sample Wt. (g)	X DF (ug/mL)	Blank Corrected (ug/mL)
09168	Method Blank	0.002 ✓	1	0.0047 ✓	5.0158 ✓	0.0047 ✓	
09169	S 1033	0.046 ✓	1	0.0870 ✓	5.0884 ✓	0.0855 ✓	0.08076 ✓
09170	BD 1033	0.145 ✓	1	0.2721 ✓	5.8754 ✓	0.2315 ✓	0.22680
09171	S 1036	0.483 ✓	1	0.9039 ✓	5.5345 ✓	0.8166 ✓	0.81189
09172	MS 1036	0.281 ✓	1	0.5263 ✓	1.0630 ✓	2.4755 ✓	2.47079
09173	S 1042	0.003 ✓	1	0.0066 ✓	5.6535 ✓	0.0058 ✓	0.00112
09174	S 1046	-0.002 ✓	1	-0.0027 ✓	5.3377 ✓	-0.0026 ✓	-0.00257 ✓
09175	BD 1046	-0.002 ✓	1	-0.0027 ✓	5.2456 ✓	-0.0026 ✓	-0.00262 ✓
09176	MS 1046	0.110 ✓	1	0.2066 ✓	5.1310 ✓	0.2014 ✓	0.19663 ✓
09177	S 2033	0.027 ✓	1	0.0515 ✓	5.0679 ✓	0.0508 ✓	
09178	S 2036	0.193 ✓	1	0.3618 ✓	5.2775 ✓	0.3428 ✓	
09179	S 2042	0.007 ✓	1	0.0141 ✓	5.7524 ✓	0.0122 ✓	
09180	S 2046	-0.002 ✓	1	-0.0027 ✓	5.5862 ✓	-0.0025 ✓	
09181	S NBS 1633a	-0.001 ✓	1	-0.0027 ✓	5.1026 ✓	-0.0027 ✓	
09182	S 3033	0.082 ✓	1	0.1543 ✓	5.6539 ✓	0.1364 ✓	
09183	S 3036	0.173 ✓	1	0.3244 ✓	5.4184 ✓	0.2994 ✓	
09184	S 3046	0.003 ✓	1	0.0066 ✓	5.9964 ✓	0.0055 ✓	
09185	Low Ref Spike	0.107 ✓	1	0.2010 ✓	5.1068 ✓	0.1968 ✓	0.19210 ✓
09186	Method Blank 2	-0.002 ✓	1	-0.0027 ✓	5.7239 ✓	-0.0024 ✓	
09187	High Ref Spike	0.234 ✓	1	0.4384 ✓	1.1243 ✓	1.9498 ✓	1.94509 ✓

Detection Limit Determination:

0.020 ug 0.009 ✓

Detection Limit (ug/50mL Aliquot) =

0.020 ug	0.009 ✓
0.020 ug	0.009 ✓
0.020 ug	0.008 ✓
0.020 ug	0.008 ✓

3X Standard Deviation Limit/Slope of Curve =
0.00275 ug

Drift Calculations (0.500 ug/aliquot standard):

		% Drift
Initial ICS	0.256 ✓	
ICS1	0.256 ✓	0.00
ICS2	0.271 ✓	5.86 ✓
ICS3	0.273 ✓	6.64 ✓

A negative value indicates that the sample was less than the detection limit.

Table 19. Hg CVAAS Analysis Raw Data 5-20-88

Project No.: 8910L02-13	CVAAS Data File: 520A
Lotus File: 0422	Analyst: E. McClendon
Data Analyst: E. McClendon	Date: 5-20-88
Date: 6-13-88	
Analyte: Hg	

Sample Analysis Data:
Instrumental Detection Limit: (ug, see below)
Verified by: Ed McClendon 6-17-88

Std or ASF Bar Code	Absorbance
0.000 ug/50mL Aliquot	0.002 ✓
0.020 ug/50mL Aliquot	0.011 ✓
0.050 ug/50mL Aliquot	0.027 ✓
0.100 ug/50mL Aliquot	0.055 ✓
0.250 ug/50mL Aliquot	0.140 ✓
0.500 ug/50mL Aliquot	0.259 ✓
0.750 ug/50mL Aliquot	0.320 ✓
1.000 ug/50mL Aliquot	0.516 ✓

Regression Output:

Constant		0.0043007035 ✓
Std Err of Y Est		0.02380741
R Squared		0.9857173178
No. of Observations		8
Degrees of Freedom		6
X Coefficient(s)	0.4852413378 ✓	
Std Err of Coef.	0.0238457431	
Correlation Coefficient		0.9928329758 ✓

ASF Bar Code	Sample Description	Absorbance	Dilution Factor	Result (ug)	Initial Sample Wt. (g)	X DF (ug/mL)
Blank 2-24	Method Blank	0.002 ✓	1	-0.0158 ✓	5.6745 ✓	-0.0140 ✓
04379	S 18002	0.000 ✓	1	-0.0158 ✓	5.2699 ✓	-0.0150 ✓
04379 dup	D 18002	-0.001 ✓	1	-0.0158 ✓	5.6211 ✓	-0.0141
04379 spk	MS 18002	0.275 ✓	500 ✓	0.5579 ✓	5.7842 ✓	241.1160 ✓

Detection Limit Determination:

0.020 ug	0.011 ✓
0.020 ug	0.019 ✓
0.020 ug	0.015 ✓
0.020 ug	0.014 ✓
0.020 ug	0.015 ✓

Detection Limit (ug/50mL Aliquot) =
3X Standard Deviation Limit/Slope of Curve =
0.0158 ug

Drift Calculations (0.500 ug/aliquot standard):

		% Drift
Initial ICS	0.259 ✓	
ICS1	0.252 ✓	2.70

A negative value indicates that the sample was less than the detection limit.

Project 8910L Part II
Part IV
ICP-AES Data Reporting Sheet-6-788
EdMcClendon 6-17-88
1357:40

ICP-AES DATA REPORTING SHEET

Project No.: 8910L0213
Sample Matrix: 0.5M H_3BO_3/10% HNO_3
Elements: Cd, Cr, Pb

Analyst: EMcClendon/
Date: 6-7-88
Digestion Code: Not applicable

Profile 415
274
689 344

Instrumental Parameters

Forward Power (kw): 1.15
Reflected Power (w): <5 minimized
Observation Height (mm): *
Nebulizer Type: FCF
(FCF = Fixed crossflow)
(HS = High solids)

Coolant Gas Flow (l/min): 15.1
Auxiliary Gas Flow (l/min): 0.2
Sample Gas Flow (l/min): 0.6
Solution Uptake (ml/min): 2.0
Peristaltic Pump Used?: Yes

* Point of maximum Cd signal/noise ratio, manufacturer recommended

Sample Analysis

ACT Name: ALL2

Test Performed:

☐ Spectrum Scan
Integration Time (sec):
Data Files: DL1:60788.BRN
Disk Name:

☑ Quantitation and Log
Command String:
Burn Files (No. Burns):
Detection Limit File:
Spike Level File:
~~ASC Burn Fil~~e: 5s
Integration

☐ Quantitation and Store
Command String:
Sequential File:

Project 89106 ~~Aut~~ Part # ELM 6-17-88
LVI

Control Table Editor Output - 6-7-88
E.L. McClendon 6-17-88
1357:40

```
 CTE
CONTROL TABLE EDITOR - V1.1

CTE>
(C)REATE, (E)DIT, (P)RINT, OR E(X)IT? P
ACT? ALA\ALA\ALL2
GROUP? A
ACT ALL2  LENGTH 2816

MAX LCN   30
CRATIO    N
FLUSH     0
FORMAT    1
          10
          10
          9
STD NAME
PBURN     0    EXPOS     5
CRCON      .00000
SSCNT     1
SSWAV     30



GROUP 2  LENGTH 728

ROW  ELEMENT  WAVEL TIMG    IS LCN INTEG  NSTD

1        LV     1001  1       0      0       1
2        AG     3280  1       1      0       1
3        AL     3082  1       1      0       1
4        AS     1936  1       1      0       1
5         B     2496  1       1      0       1
6        BA     4934  1       1      0       1
7        BE     2348  1       1      0       1
8        CA     3968  1       1      0       1
9        CD     2288  1       1      0       1
10       CO     2286  1       1      0       1
11       CR     2677  1       1      0       1
12       CU     3247  1       1      0       1
13       FE     2599  1       1      0       1
14       FE     2714  1       1      0       1
15       HG     1942  1       1      0       1
16        K     7664  1       1      0       1
17       MG     2795  1       1      0       1
18       MN     2576  1       1      0       1
19       MO     2020  1       1      0       1
20       NA     5890  1       1      0       1
21       NI     2316  1       1      0       1
22        P     2149  1       1      0       1
23       PB     2203  1       1      0       1
24       SB     2068  1       1      0       1
25       SE     1960  1       1      0       1
26       SN     1899  1       1      0       1
27       TI     3349  1       1      0       1
28       TL     1908  1       1      0       1
29        Y     3710  1       1      0       1
30       ZN     2138  1       1      0       1
```

```
ROW    GAIN        INTENSITY        LBK          RBK

1    1.00000       1.00000        .00000       .00000
2    1.00000       1.00000       1.00000      1.00000
3    1.00000       1.00000        .00000      2.00000
4    1.00000       1.00000       2.00000       .00000
5    1.00000       1.00000       1.00000      1.00000
6    1.00000       1.00000       1.00000      1.00000
7    1.00000       1.00000        .00000       .00000
8    1.00000       1.00000       1.00000      1.00000
9    1.00000       1.00000       1.00000      1.00000
10   1.00000       1.00000        .00000       .00000
11   1.00000       1.00000        .00000       .00000
12   1.00000       1.00000       2.00000       .00000
13   1.00000       1.00000        .00000      2.00000
14   1.00000       1.00000        .00000       .00000
15   1.00000       1.00000       1.00000      1.00000
16   1.00000       1.00000        .00000       .00000
17   1.00000       1.00000       1.00000      1.00000
18   1.00000       1.00000        .00000       .00000
19   1.00000       1.00000       1.00000      1.00000
20   1.00000       1.00000       1.00000      1.00000
21   1.00000       1.00000       1.00000      1.00000
22   1.00000       1.00000       2.00000       .00000
23   1.00000       1.00000        .00000      2.00000
24   1.00000       1.00000        .00000       .00000
25   1.00000       1.00000       1.00000      1.00000
26   1.00000       1.00000       1.00000      1.00000
27   1.00000       1.00000       1.00000      1.00000
28   1.00000       1.00000        .00000       .00000
29   1.00000       1.00000       1.00000      1.00000
30   1.00000       1.00000        .00000       .00000
```

```
GROUP 3  LENGTH 788

ROW       A0            A1            A2           EXPON

1       .00000       1.00000       .00000       1.00000
2       .02033        .45831       .00000       1.00000
3       .05799        .03692       .00000       1.00000
4     - .01277        .07610       .00000       1.00000
5     -83.2414      -1.60734       .00000       1.00000
6       .00197       1.08419       .00000       1.00000
7       .01632       10.0243       .00000       1.00000
8       .02134       1.20016       .00000       1.00000
9     - .00113       2.98901       .00000       1.00000
10      .30793       3.51965       .00000       1.00000
11      .93163       1.63929       .00000       1.00000
12      .02246        .42538       .00000       1.00000
13      .02012       8.29218       .00000       1.00000
14    18.2790         .04653       .00000       1.00000
15      .02402       2.01447       .00000       1.00000
16    107.009         .01401       .00000       1.00000
17      .00204       4.07072       .00000       1.00000
18      .05367       7.34535       .00000       1.00000
19    - .46679       1.47103       .00000       1.00000
20      .15762        .58499       .00000       1.00000
21    - .00401       1.13123       .00000       1.00000
22    - .00191       3.07142       .00000       1.00000
23      .02555        .75106       .00000       1.00000
24     3.32721        .56769       .00000       1.00000
25    - .00216        .37823       .00000       1.00000
26      .00000        .00000       .00000       1.00000
27    [illegible]    1.48386       .00000       1.00000
28    [illegible]     .81097       .00000       1.00000
29    - .00078       1.08990       .00000       1.00000
30    [illegible]    11.9389       .00000       1.00000
```

(NOTE: Best Copy Available)

```
PRIOR NDIG     HIGH          LOW

  1      5   20000.0        .00000
         5   100.000      -99.0000
  1      5   1000.00      -99.0000
  1      5   500.000      -99.0000
  1      5   100.000      -99.0000
         5   50.0000      -99.0000
  1      5   10.0000      -99.0000
         5   50.0000      -99.0000
  1      5   200.000      -99.0000
  1      5   100.000      -99.0000
  1      5   50.0000      -99.0000
         4   150.000      -99.0000
  1      5   100.000      -99.0000
         5   1000.00      -99.0000
  1      5   500.000      -99.0000
         5   1000.00      -99.0000
         5   20.0000      -99.0000
         5   50.0000      -99.0000
  1      5   50.0000      -99.0000
         5   1000.00      -99.0000
  1      5   200.000      -99.0000
         5   1000.00      -99.0000
         5   500.000      -99.0000
         5   500.000      -99.0000
  1      5   200.000      -99.0000
  1      5   500.000      -99.0000
  1      5   50.0000      -99.0000
         5   200.000      -99.0000
  1      5   50.0000      -99.0000
  1      4   10.0000      -99.0000
```

(NOTE: Best Copy Available)

```
GROUP 4  LENGTH 3[illegible]

ROW  COLN  ELEMENT       [illegible]

[illegible]   4      AL       .00000      .0000[illegible]
[illegible]   2[illegible]   AL   .000[illegible]3   [illegible]
[illegible]   [illegible]   AL   .00000   [illegible]
[illegible]   [illegible]   AL   .00001   [illegible]
[illegible]   23     AL       .00197      [illegible]
[illegible]   [illegible]   [illegible]   .00225   .0000[illegible]
[illegible]   [illegible]   AL   .00375   .00000
[illegible]   [illegible]   [illegible]   .00[illegible]   .0000[illegible]
[illegible]   [illegible]   AL   .00027   .00000
[illegible]   [illegible]   [illegible]   .00001   .00000
[illegible]   25     CA       .00055      .0001[illegible]
[illegible]   [illegible]   [illegible]   .000[illegible]7   .000[illegible]
[illegible]   [illegible]   FE   .00000   .0000[illegible]
[illegible]   [illegible]   [illegible]   .00035   [illegible]
[illegible]   [illegible]   FE   .00011   .0000[illegible]
[illegible]   [illegible]   FE   .00000   .0000[illegible]
17    18     FE       .00011      .00000
18    [illegible]   FE   .00000   .00000
19    24     FE       .00098      .00000
20    2[illegible]   FE   .00340   .00000
21    28     FE       .00296      .00000
22    30     FE       .00016      .00000
23    0      FE       .00000      .00000
24    0      FE       .00000      .00000
25    0      FE       .00000      .00000
26    0      FE       .00000      .00000
27    0      FE       .00000      .00000
28    0      AL       .00000      .00000
29    0      MG       .00000      .00000
30    0      AL       .00000      .00000
31    0      FE       .00000      .00000


GROUP 7  LENGTH 28

ROW  SSTD

1    BLAN
2    MRI5
3    MRI6
4    MRI7
5    LLIN
```

(NOTE: Best Copy Available)

```
GROUP 8  LENGTH 68

DAY  LOSTD   HISTD

      0       0
      1       2
      1       3
      1       3
      1       3
      1       3
      1       3
      1       3
      1       2
10    1       1
11    1       1
12    1       1
13    1       1
14    1
15    1       3
16    1
17    1       5
18    1       3
19    1       3
20    1       4
21    1       3
22    1       4
23    1       2
24    1       3
25    1       2
26    1       3
27    1       3
28    1       2
29    1       2
30    1       5
```

```
GROUP 9  LENGTH 124

ROW  CONC

1      .00000
2      .00000
3      .00000
4      .00000
5      .00000
6      .00000
7      .00000
8      .00000
9      .00000
10     .00000
11     .00000
12     .00000
13     .00000
14     .00000
15     .00000
16     .00000
17     .00000
18     .00000
19     .00000
20     .00000
21     .00000
22     .00000
23     .00000
24     .00000
25     .00000
26     .00000
27     .00000
28     .00000
29     .00000
```

```
P 10  LENGT- 128

CONC

 .00000
10.0000
 .00000
 .00000
[illegible]
 .00000
[illegible]
```

(NOTE: Best Copy Available)

```
    CONC

 1  [illegible]
 2  10.0000
 3   .00000
 4  10.0000
 5  10.0000
 6  10.0000
 7  10.0000
 8   .00000
 9   .00000
10   .00000
11   .00000
12   .00000
13   .00000
14   .00000
15  10.0000
16   .00000
17   .00000
18  10.0000
19  10.0000
20   .00000
21  10.0000
22   .00000
23   .00000
24  10.0000
25   .00000
26  10.0000
27  10.0000
28   .00000
29   .00000
30   .00000
```

(NOTE: Best Copy Available)

```
GROUP 12  LENGTH 128

ROW  CONC

1       .00000
2       .00000
3     150.000
4       .00000
5       .00000
6       .00000
7       .00000
8       .00000
9       .00000
10      .00000
11      .00000
12      .00000
13      .00000
14    150.000
15      .00000
16    150.000
17      .00000
18      .00000
19      .00000
20    150.000
21      .00000
22    150.000
23      .00000
24      .00000
25      .00000
26      .00000
27      .00000
28      .00000
29      .00000
30      .00000
```

```
GROUP 13  LENGTH 128

ROW  CONC

1      .00000
2      .00000
3      .00000
4      .00000
5      .00000
6      .00000
7     5.00000
8      .00000
9      .00000
10     .00000
11     .00000
12     .00000
13    5.00000
14     .00000
15     .00000
16     .00000
17    5.00000
18     .00000
19     .00000
20     .00000
21     .00000
22     .00000
23     .00000
24     .00000
25     .00000
26     .00000
27     .00000
28     .00000
29     .00000
30    5.00000
```

```
GROUP 14  LENGTH 124

ROW  CONC

1     .00000
2     .00000
3     .00000
4     .00000
5     .00000
6     .00000
7     .00000
8     .00000
9     .00000
10    .00000
11    .00000
12    .00000
13    .00000
14    .00000
15    .00000
16    .00000
17    .00000
18    .00000
19    .00000
20    .00000
21    .00000
22    .00000
23    .00000
24    .00000
25    .00000
26    .00000
27    .00000
28    .00000
29    .00000



ACT? ^Z

CTE>
(C)REATE, (E)DIT, (P)RINT, OR E(X)IT? X

>
```

Project 8410c Part~~III~~ Part XVI
DEC Command Files Used - 6-7.
EHMcClendon 6-17-88
1357:40

```
 PIP
PIP>TTO:=START.CMD
EC+
;
;
;
;       THE START COMMAND WILL DISABLE THE DOOR SWITCH AND ECHO.
;       DATA OUTPUT FORMAT WILL BE SET TO 'CO', CONCENTRATION.
;       IT WILL THEN SET AND EXECUTE THE PROFILE COMMAND ON CHANNEL
;       '31' THE CD CHANNEL.  IF YOU WISH TO PROFILE ANOTHER CHANNEL,
;       THEN ENTER THAT ELEMENT'S PCN NUMBER WHEN THE SYSTEM PROMPTS
;       - ENTER VALUE>.  IF NOT, THEN SIMPLY PRESS THE CARRIAGE
;       RETURN.
;
;
;
EC-
DR-
CO
PF'31'
T2
PIP>


    TTO:=STD.CMD
EADKAN
EACOANANANANAN
TDTLTPLA
BITDTLTPLA
NS
T2
PIP>


    TTO:=BLANK.CMD
EADKAN
EACOANANANANAN
BATBBS+LA
T2
PIP>


    TTO:=S.CMD
SC'EADKANEACOANANANANANTDTLTPLABITDTLTPLA'
T2
PIP>^Z

>
```

Project 8910L Part#2 Part #~~I~~ ~~VIII~~ 6-17-88

ICAP Sample Raw Data - 6-7-88
Ed McClendon 6-17-88
1357:40

```
 SAT
SAMPLE ANALYSIS TASK 1.1
ENTER ACT NAME>ALL2
SAT>@START
::
::
:
:
:
:
      THE START COMMAND WILL DISABLE THE DOOR SWITCH AND ECHO.
:     DATA OUTPUT FORMAT WILL BE SET TO 'CO', CONCENTRATION.
:     IT WILL THEN SET AND EXECUTE THE PROFILE COMMAND ON CHANNEL
:     '31' THE CD CHANNEL.  IF YOU WISH TO PROFILE ANOTHER CHANNEL,
:     THEN ENTER THAT ELEMENT'S PCN NUMBER WHEN THE SYSTEM PROMPTS
:     - ENTER VALUE>.  IF NOT, THEN SIMPLY PRESS THE CARRIAGE
:     RETURN.
:
:
:
ED
ENTER VALUE(S)>
SAT>LD+
FILENAME? >DL1:60788.BRMN\NM\N
ENTER SAMPLE NAME>
ENTER CLASS NAME>
SAT>IS
BLAN MRI5 MRI6 MRI7 LLIN
SAT>@STD
ENTER SAMPLE NAME>CAL
ENTER CLASS NAME>BLANK
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5      ALL2    7-JUN-88 14:44:19
  LV
5044.0
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.07221   .12574   -2.098   71.422   .00335   -.0029   .02504   -.0002   .00018   .09057
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-15.41   -.0201   6.6607   .07946   -10.79   .01330   .06354   -4.546   .25323   -.0034
  P        PB       SB       SE       SN       TI       TL        Y       ZN
22.161   .02380   1.7245   -.0210   -.0007   .00496   .99117   .00303   .05527

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 14:44:23
  LV
.79057
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.04241   .02810   .78198   .52925   .00128   .00004   .00028   .00269   .00131   .00392
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
5.7030   .00000   .07767   .01747   .35214   .00018   .00038   .03884   .03489   .00304
  P        PB       SB       SE       SN       TI       TL        Y       ZN
62.540   .00956   .02859   .00034   .00000   .00271   .01813   .00269   .00026

DETECTION LIMIT          N=5      ALL2    7-JUN-88 14:44:33
  LV
1.5811
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.08483   .05620   1.5640   1.0585   .00255   .00008   .00056   .00538   .00262   .00784
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
11.406   .00000   .15534   .03494   .70427   .00037   .00076   .07768   .06978   .00608
  P        PB       SB       SE       SN       TI       TL        Y       ZN
125.08   .01911   .05718   .00069   .00000   .00542   .03625   .00538   .00053
```

```
% RELATIVE STANDARD DEVIATION    N=5      ALL2    7-JUN-88 14:44:45
  LV
.01567
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
58.733   22.348   -37.28   .74103   38.047   -1.353   1.1236   -1212.   744.02   4.3290
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-37.01   .00000   1.1661   21.986   -3.263   1.3744   .59706   -.8544   13.778   -90.44
   P       PB       SB       SE       SN       TI       TL        Y       ZN
282.21   40.154   1.6579   -1.642   .00000   54.602   1.8288   88.893   .47727

MEAN     N=5      ALL2     7-JUN-88 14:45:01
  LV
5044.0
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
47.000   10.800   -4.900   ******   10.800   806.60   129.20   -17.00   5466.7   7703.3
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
48.200   .00000   4290.0   244.10   7564.4   315.00   1988.5   -3464.   465.10   -22.90
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-29.60   96.800   9527.2   .00000   .00000   43.100   9582.7   -4.300   8769.1

STANDARD DEVIATION         N=5      ALL2    7-JUN-88 14:45:04
  LV
.79057
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
52.989   5.7293   1.3874   4984.0   4.0712   3.3801   .75829   22.575   25.511   30.184
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
26.078   .00000   14.013   66.996   27.569   3.7583   6.9101   29.247   60.408   7.9246
   P       PB       SB       SE       SN       TI       TL        Y       ZN
215.55   29.499   83.801   .00000   .00000   10.615   73.127   7.9420   17.515

DETECTION LIMIT            N=5      ALL2    7-JUN-88 14:45:07
  LV
1.5811
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
105.98   11.459   2.7749   9968.1   8.1425   6.7601   1.5166   45.150   51.022   60.367
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
52.156   .00000   28.026   133.99   55.138   7.5167   13.820   58.493   120.82   15.849
   P       PB       SB       SE       SN       TI       TL        Y       ZN
431.10   58.998   167.60   .00000   .00000   21.230   146.25   15.884   35.029
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 14:45:10
  LV
.01567
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
112.74   53.049   -28.32   .73852   37.697   .41905   .58691   -132.8   .46666   .39183
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
54.104   .00000   .32664   27.446   .36446   1.1931   .34751   -.8444   12.988   -34.61
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-726.2   30.474   .87960   .00000   .00000   24.628   .76311   -184.7   .19973
ENTER STANDARD NAME>BLANKJ\J
SAT>@STD
ENTER SAMPLE NAME>10PPM
ENTER CLASS NAME>MRIS
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5     ALL2    7-JUN-88 14:48:50
  LV
5044.9
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
18.243   -.0179   -1.985   74.357   .00602   7.7144   22.215   17.386   9.1605   10.944
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-4652.   -.0201   21.991   .06297   -10.03   .01335   .06896   -4.637   .32245   .02127
   P       PB       SB       SE       SN       TI       TL        Y       ZN
14253.   11.744   1.7816   -.0848   -.0010   .00858   10.526   18.225   12.442

STANDARD DEVIATION     N=5     ALL2    7-JUN-88 14:48:54
  LV
.65125
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.12297   .04704   5.9332   4.3743   .00141   .02143   .13918   .09709   .05380   .03801
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
33.811   .00000   .11999   .01690   .31965   .00013   .00052   .01320   .04318   .00620
   P       PB       SB       SE       SN       TI       TL        Y       ZN
167.99   .04812   .01897   .00044   .00024   .00231   .05379   .12063   .03125

DETECTION LIMIT        N=5     ALL2    7-JUN-88 14:49:04
  LV
1.3025
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.24594   .09408   11.866   8.7486   .00282   .04286   .27837   .19418   .10759   .07601
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
67.622   .00000   .23997   .03380   .63931   .00026   .00105   .02640   .08635   .01239
   P       PB       SB       SE       SN       TI       TL        Y       ZN
335.97   .09624   .03794   .00089   .00048   .00463   .10758   .24126   .06251

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 14:49:16
  LV
.01291
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.67408   -262.2   -298.8   5.8828   23.475   .27782   .62653   .55843   .58727   .34726
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.7268   .00000   .54563   26.838   -3.188   .97317   .75987   -.2846   13.390   29.135
   P       PB       SB       SE       SN       TI       TL        Y       ZN
1.1786   .40974   1.0649   -.5245   -24.84   26.964   .51101   .66189   .25120
```

not used - needed recalibration later - ESPM 6-17-88

```
MEAN     N=5      ALL2     7-JUN-88 14:49:32
  LV
5044.9
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
22750.   -18.50   -5.100   ******   19.300   ******   60796.   ******   ******   88949.
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
21255.   .00000   7010.4   180.90   7624.3   316.00   2111.3   -3532.   585.00   41.300
   P       PB       SB       SE       SN       TI       TL        Y       ZN
49023.   36091.   9745.0   .00000   -.3000   57.300   47841.   53782.   ******

STANDARD DEVIATION       N=5      ALL2     7-JUN-88 14:49:34
  LV
.65125
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
153.32   9.5917   10.532   41019.   4.5083   1080.3   378.17   811.23   1011.6   280.19
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
153.70   .00000   21.649   64.799   25.225   2.6926   9.4445   9.4968   74.758   16.154
   P       PB       SB       SE       SN       TI       TL        Y       ZN
579.87   150.28   56.125   .00000   .27386   9.0733   215.19   353.98   1801.4

DETECTION LIMIT          N=5      ALL2     7-JUN-88 14:49:37
  LV
1.3025
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
306.64   19.183   21.064   82039.   9.0167   2160.6   756.34   1622.5   2023.2   560.38
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
307.41   .00000   43.298   129.60   50.450   5.3852   18.889   18.994   149.52   32.308
   P       PB       SB       SE       SN       TI       TL        Y       ZN
1159.7   300.56   112.25   .00000   .54772   18.147   430.38   707.97   3602.8

% RELATIVE STANDARD DEVIATION   N=5      ALL2     7-JUN-88 14:49:41
  LV
.01291
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
.67395   -51.85   -206.5   6.3350   23.359   .27602   .62204   .55642   .56860   .31500
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.72316   .00000   .30881   35.820   .33085   .85208   .44733   -.2689   12.779   39.114
   P       PB       SB       SE       SN       TI       TL        Y       ZN
1.1829   .41639   .57593   .00000   -91.29   15.835   .44980   .65819   .23860
ENTER STANDARD NAME>MRI5
SAT>@STD
ENTER SAMPLE NAME>10PPM
ENTER CLASS NAME>MRI6A
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>
```

```
MEAN     N=5     ALL2    7-JUN-88 14:52:28
  LV
5044.7
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-.4150   9.1546   -2165.   80.077   17.140   -.0042   .04844   .19312   .03599   .48581
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
1417.2   -.0201   14.644   26.580   -1.104   19.072   21.342   94.525   17.039   21.889
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-104.5   .02851   11.377   -.0820   -.0005   19.110   1.1039   .00462   .14491

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 14:52:32
  LV
.67111
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.04117   .08929   23.880   1.3941   .12135   .00030   .00114   .00281   .00110   .00343
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
17.793   .00000   .08016   .31726   .16151   .05802   .11602   .79307   .15726   .14443
   P       PB       SB       SE       SN       TI       TL        Y       ZN
25.956   .02028   .11563   .00054   .00024   .10126   .01697   .00163   .00070

DETECTION LIMIT          N=5     ALL2    7-JUN-88 14:52:42
  LV
1.3422
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.08234   .17858   47.761   2.7882   .24271   .00059   .00229   .00561   .00220   .00686
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
35.586   .00000   .16032   .63453   .32303   .11605   .23205   1.5861   .31453   .28886
   P       PB       SB       SE       SN       TI       TL        Y       ZN
51.911   .04056   .23127   .00108   .00048   .20253   .03393   .00326   .00141

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 14:52:54
  LV
.01330
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-9.921   .97533   -1.103   1.7409   .70802   -7.097   2.3620   1.4534   3.0509   .70558
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
1.2555   .00000   .54742   1.1936   -14.64   .30423   .54365   .83901   .92296   .65981
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-24.83   71.139   1.0164   -.6567   -45.46   .52990   1.5370   35.304   .48609

MEAN     N=5     ALL2    7-JUN-88 14:53:10
  LV
5044.7
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-561.7   1852.1   3834.3   ******   54705.   898.10   193.20   1604.4   6163.4   10663.
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-6504.   .00000   5706.8   ******   8306.0   ******   ******   70745.   29518.   57044.
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-466.3   165.90   38167.   .00000   .20000   74899.   10180.   .40000   14284.

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 14:53:12
  LV
.67111
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
51.430   18.146   42.294   13062.   386.49   14.324   3.1145   23.673   20.038   25.890
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
81.191   .00000   14.606   1215.4   11.895   1196.1   2023.7   592.66   272.41   376.02
   P       PB       SB       SE       SN       TI       TL        Y       ZN
89.459   62.673   341.81   .00000   .27386   394.75   69.017   4.8140   42.642
```

```
DETECTION LIMIT          N=5     ALL2    7-JUN-88 14:53:15
  LV
1.3422
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
102.86   36.293   84.588   26125.   772.98   28.648   6.2289   47.347   40.076   51.781
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
162.38   .00000   29.211   2430.8   23.791   2392.2   4047.3   1185.3   544.82   752.05
  P        PB       SB       SE       SN       TI       TL       Y        ZN
178.92   125.35   683.62   .00000   .54772   789.51   138.03   9.6281   85.285
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 14:53:19
  LV
.01330
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-9.156   .97977   1.1030   2.1995   .70650   1.5949   1.6120   1.4755   .32511   .24281
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-1.248   .00000   .25593   1.1931   .14321   .30536   .54321   .83773   .92285   .65918
  P        PB       SB       SE       SN       TI       TL       Y        ZN
-19.18   37.778   .89557   .00000   136.93   .52704   .67794   1203.5   .29853
ENTER STANDARD NAME>MRI6
SAT>@STD
ENTER SAMPLE NAME>150PPM
ENTER CLASS NAME>MRI7
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 14:56:15
  LV
5044.6
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.08246   137.12   -262.2   71.506   .01106   .01261   265.66   -.0230   -.0124   .14829
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-20.09   -.0201   205.13   .11671   127.96   .02048   .07218   -5.886   256.01   -.0026
  P        PB       SB       SE       SN       TI       TL       Y        ZN
******   .13781   1.4334   -1.356   -.0010   .01029   .68167   -.0663   .05587
STANDARD DEVIATION       N=5     ALL2    7-JUN-88 14:56:20
  LV
.41728
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.03536   .42561   6.8025   .35294   .00102   .00058   .24968   .00153   .00104   .00488
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
5.7230   .00001   .74447   .02968   .57044   .00129   .00148   .04583   .66823   .00528
  P        PB       SB       SE       SN       TI       TL       Y        ZN
647.64   .01548   .02347   .00396   .00049   .00217   .02078   .00145   .00071
DETECTION LIMIT          N=5     ALL2    7-JUN-88 14:56:30
  LV
.83456
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.07073   .85122   13.605   .70588   .00205   .00116   .49936   .00306   .00207   .00976
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
11.446   .00003   1.4889   .05937   1.1409   .00258   .00296   .09166   1.3365   .01056
  P        PB       SB       SE       SN       TI       TL       Y        ZN
1295.3   .03097   .04694   .00792   .00099   .00434   .04156   .00289   .00141
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 14:56:42
  LV
.00827
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
42.890   .31039   -2.595   .49358   9.2514   4.5884   .09398   -6.649   -8.359   3.2899
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-28.49   -.0651   .36292   25.432   .44581   6.2879   2.0515   -.7787   .26102   -206.6
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.09604   11.235   1.6374   -.2922   -51.71   21.064   3.0487   -2.182   1.2631

MEAN     N=5      ALL2     7-JUN-88 14:56:57
  LV
5044.6
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
59.800   27948.   456.70   ******   35.400   5425.5   ******   -208.3   5726.2   8136.2
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
69.600   .10000   39499.   387.00   18170.   462.40   2624.7   -4467.   ******   -20.80
  P        PB       SB       SE       SN       TI       TL       Y        ZN
******   1275.8   10201.   .10000   -.3000   64.000   11513.   -208.8   11296.

STANDARD DEVIATION        N=5      ALL2     7-JUN-88 14:57:00
  LV
.41728
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
44.187   88.737   12.091   3355.4   3.2673   35.466   637.89   12.838   19.610   36.995
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
26.176   .54772   135.02   113.85   45.032   26.447   25.275   34.568   1168.3   13.760
  P        PB       SB       SE       SN       TI       TL       Y        ZN
2291.6   49.453   70.892   .22361   .57009   8.5000   88.747   4.2515   47.576

DETECTION LIMIT           N=5      ALL2     7-JUN-88 14:57:03
  LV
.83456
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
88.373   177.47   24.183   6710.8   6.5345   70.931   1275.8   25.677   39.221   73.989
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
52.352   1.0954   270.04   227.70   90.064   52.893   50.550   69.135   2336.7   27.519
  P        PB       SB       SE       SN       TI       TL       Y        ZN
4583.2   98.905   141.78   .44721   1.1402   17.000   177.49   8.5030   95.152
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 14:57:07
  LV
.00827
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
73.891   .31751   2.6475   .49771   9.2295   .65369   .08782   -6.163   .34247   .45469
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
37.609   547.72   .34183   29.419   .24784   5.7194   .96296   -.7738   .26366   -66.15
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.09860   3.8762   .69491   223.61   -190.0   13.281   .77086   -2.036   .42117
ENTER STANDARD NAME>MRI7
SAT>SSWA
ENTER VALUE(S)>
HIGH STD VALUES MISSING FOR LCN:7
HIGH STD VALUES MISSING FOR LCN:13
HIGH STD VALUES MISSING FOR LCN:17
HIGH STD VALUES MISSING FOR LCN:25
LOW STD VALUE = 0 FOR LCN:26
HIGH STD VALUES MISSING FOR LCN:30
SAT>@BLANK
ENTER SAMPLE NAME>BLANK
ENTER CLASS NAME>ARRAY
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

BLANK ARRAY     ALL2    7-JUN-88 15:09:47
  LV
5043.9
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-.0120   -.0172   -.0344   -.1059   -.0001   -.0005   .00025   -.0005   .00113   .00251
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-.0245   -.0201   .00121   -.0051   .25394   .01318   -.0002   -.0111   -.0056   -.0012
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.00926   -.0033   .09080   .00222   .00000   -.0009   .02114   -.0011   .0585
SAT>@S
SAT>PC
ENTER SAMPLE NAME>CAL
ENTER CLASS NAME>BLAM\M\NK
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 15:12:38
BLANK SUBTRACTED
  LV
5043.6
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.02459   .04189   .02527   -.3737   .00101   .00009   -.0000   .00159   .00523   .01173
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.01033   .00000   .23844   -.0044   1.0929   .00022   .00059   -.0077   .02275   .00333
  P        PB       SB       SE       SN       TI       TL       Y        ZN
-.0201   .01651   .02855   -.0010   -25.00   .00222   .00498   .00245   .00234
```

```
STANDARD DEVIATION       N=5      ALL2    7-JUN-88 15:12:43
BLANK SUBTRACTED
  LV
.54770
  AG       AL        AS        B        BA        BE        CA        CD        CO        CR
.00691   .02944   .03255   .62704   .00033   .00003   .00013   .00139   .00124   .00276
  CU       FE        FE        HG        K        MG        MN        MO        NA        NI
.00232   .00000   .06750   .00608   .26858   .00014   .00012   .00602   .01677   .00186
  P        PB        SB        SE        SN        TI        TL        Y         ZN
.02125   .01099   .03231   .00031   .00272   .00054   .01985   .00086   .00049

DETECTION LIMIT          N=5      ALL2    7-JUN-88 15:12:53
BLANK SUBTRACTED
  LV
1.0954
  AG       AL        AS        B        BA        BE        CA        CD        CO        CR
.01382   .05889   .06509   1.2541   .00065   .00007   .00026   .00279   .00249   .00553
  CU       FE        FE        HG        K        MG        MN        MO        NA        NI
.00464   .00000   .13501   .01216   .53717   .00029   .00024   .01205   .03354   .00372
  P        PB        SB        SE        SN        TI        TL        Y         ZN
.04249   .02198   .06462   .00062   .00544   .00108   .03971   .00172   .00099

% RELATIVE STANDARD DEVIATION   N=5      ALL2    7-JUN-88 15:13:06
BLANK SUBTRACTED
  LV
.01086
  AG       AL        AS        B        BA        BE        CA        CD        CO        CR
28.095   70.284   128.81   -167.8   32.538   38.477   -416.6   87.529   23.780   23.566
  CU       FE        FE        HG        K        MG        MN        MO        NA        NI
22.455   .00000   28.311   -137.0   24.575   64.796   20.154   -77.85   73.709   55.859
  P        PB        SB        SE        SN        TI        TL        Y         ZN
-105.9   66.559   113.18   -31.99   -.0109   24.257   398.61   35.026   21.093

MEAN     N=5      ALL2    7-JUN-88 15:13:21
  LV
5043.6
  AG       AL        AS        B        BA        BE        CA        CD        CO        CR
75.600   15.400   -8.400   ******   15.800   808.90   130.50   -.9000   5576.3   7818.3
  CU       FE        FE        HG        K        MG        MN        MO        NA        NI
18.100   .00000   4345.9   147.10   7659.0   316.90   2004.5   -3603.   515.80   -10.90
  P        PB        SB        SE        SN        TI        TL        Y         ZN
-197.0   144.40   9869.0   .00000   -.5000   53.100   9684.7   3.0000   9039.2

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 15:13:24
  LV
.54770
  AG       AL        AS        B        BA        BE        CA        CD        CO        CR
15.674   5.4818   12.492   5091.2   1.7889   2.7249   .79057   20.305   21.182   22.217
  CU       FE        FE        HG        K        MG        MN        MO        NA        NI
4.9168   .00000   15.602   61.751   18.490   2.9026   4.5000   45.005   49.444   10.615
  P        PB        SB        SE        SN        TI        TL        Y         ZN
329.14   39.485   92.563   .00000   .00000   4.0218   75.263   4.6233   29.761
```

```
DETECTION LIMIT          N=5     ALL2    7-JUN-88 15:13:27
  LV
1.0954
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
31.348   10.964   24.984   10182.   3.5777   5.4497   1.5811   40.610   42.364   44.433
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
9.8336   .00000   31.204   123.50   36.979   5.8051   9.0000   90.010   98.888   21.230
  P        PB       SB       SE       SN       TI       TL        Y       ZN
658.27   78.970   185.13   .00000   .00000   8.0436   150.53   9.2466   59.521

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:13:30
  LV
.01086
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
20.733   35.596   -148.7   .75014   11.322   .33686   .60580   -2256.   .37986   .28416
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
27.165   .00000   .35900   41.979   .24141   .91592   .22450   -1.249   9.5859   -97.38
  P        PB       SB       SE       SN       TI       TL        Y       ZN
-167.1   27.344   .93791   .00000   .00000   7.5740   .77714   154.11   .32924
SAT>PC
ENTER SAMPLE NAME>NBS
ENTER CLASS NAME>1643B 1/2
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5     ALL2    7-JUN-88 15:16:02
BLANK SUBTRACTED
  LV
5044.9
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.00674   .02308   .07371   36.331   .02143   .00825   18.280   .01377   .01937   .03320
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.01985   .00000   .69205   -.0081   4.3492   8.7960   .01552   .27523   4.1619   .03142
  P        PB       SB       SE       SN       TI       TL        Y       ZN
-.0086   .00926   -.8664   -.0125   -25.00   -.0011   -.4759   .00017   .05856

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 15:16:06
BLANK SUBTRACTED
  LV
1.0841
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.01183   .02720   .03500   .03789   .00078   .00006   .04101   .00134   .00093   .00312
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.00649   .00000   .06873   .00919   .35365   .01409   .00008   .00260   .00915   .00332
  P        PB       SB       SE       SN       TI       TL        Y       ZN
.01730   .01560   .01672   .00030   .00537   .00109   .00588   .00076   .00072

DETECTION LIMIT          N=5     ALL2    7-JUN-88 15:16:17
BLANK SUBTRACTED
  LV
2.1683
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.02365   .05440   .07000   .07578   .00156   .00011   .08202   .00269   .00187   .00624
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.01298   .00000   .13745   .01838   .70729   .02818   .00016   .00520   .01830   .00664
  P        PB       SB       SE       SN       TI       TL        Y       ZN
.03459   .03120   .03344   .00061   .01075   .00217   .01176   .00153   .00143
```

do not use values – recalibrated later for Cd, Cd Pb
6-17-88

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:16:29
BLANK SUBTRACTED
  LV
.02149
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
175.50   117.85   47.477   .10429   3.6369   .68631   .22435   9.7541   4.8215   9.3912
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
32.690   .00000   9.9310   -113.0   8.1313   .16018   .50354   .94398   .21987   10.565
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-202.1   168.54   -1.930   -2.428   -.0215   -94.40   -1.236   454.84   1.2252

MEAN     N=5      ALL2    7-JUN-88 15:16:45
  LV
5044.9
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
35.100   11.900   10.200   ******   127.50   1230.6   ******   176.70   5822.5   7994.8
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
38.300   .00000   4453.5   109.60   7891.2   ******   2560.2   -1504.   12732.   149.40
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-18.70   118.20   7312.9   .00000   -.5000   27.900   7854.9   -9.300   12432.

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 15:16:48
  LV
1.0841
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
26.850   5.0670   13.438   278.93   4.2720   3.7316   239.70   19.611   16.867   25.716
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
13.764   .00000   16.632   93.433   25.709   303.16   3.2900   19.138   28.566   18.919
   P       PB       SB       SE       SN       TI       TL        Y       ZN
268.01   56.343   47.688   .00000   .00000   8.1271   21.420   4.1018   44.790

DETECTION LIMIT          N=5     ALL2    7-JUN-88 15:16:51
  LV
2.1683
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
53.700   10.134   26.876   557.85   8.5440   7.4631   479.41   39.221   33.733   51.432
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
27.528   .00000   33.264   186.87   51.417   606.32   6.5799   38.275   57.132   37.838
   P       PB       SB       SE       SN       TI       TL        Y       ZN
536.01   112.69   95.376   .00000   .00000   16.254   42.839   8.2037   89.580
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:16:54
  LV
.02149
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
76.496   42.580   131.74   .07316   3.3506   .30323   .21589   11.098   .28968   .32166
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
35.938   .00000   .37346   85.249   .32579   .16754   .12850   -1.272   .22437   12.663
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-1433.   47.668   .65211   .00000   .00000   29.129   .27269   -44.11   .36028
SAT>PC
ENTER SAMPLE NAME>1PPM
ENTER CLASS NAME>MRI1A
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 15:19:29
BLANK SUBTRACTED
  LV
5044.4
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
1.0138   .03007   .02866   -.9939   .00064   .82052   .99475   1.0313   1.0258   1.0100
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
1.0158   .00000   1.4165   .00093   .86782   .00029   .00093   -.0170   .00825   .00356
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.33527   1.0655   .10368   -.0055   -20.00   .00194   1.0603   .99045   1.4868
```

not used - recalibrated later 4JOM 6-17-88

```
STANDARD DEVIATION      N=5     ALL2    7-JUN-88 15:19:34
BLANK SUBTRACTED
  LV
.54781
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
.02305   .03498   .03278   .24652   .00081   .00804   .01188   .01036   .01113   .01137
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.01786   .00000   .07238   .00991   .45067   .00063   .00021   .00207   .02830   .00214
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.01571   .00793   .03809   .00033   11.181   .00147   .02800   .01159   .01420

DETECTION LIMIT         N=5     ALL2    7-JUN-88 15:19:44
BLANK SUBTRACTED
  LV
1.0956
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
.04611   .06997   .06557   .49305   .00163   .01607   .02375   .02072   .02225   .02274
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.03572   .00000   .14475   .01981   .90133   .00127   .00042   .00413   .05659   .00427
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.03143   .01586   .07619   .00067   22.361   .00293   .05600   .02318   .02841
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:19:56
BLANK SUBTRACTED
  LV
.01086
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
2.2740  116.35  114.39  -24.80  127.25  .97945  1.1938  1.0044  1.0846  1.1255
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
1.7583  .00000  5.1095  1060.8  51.931  217.60  22.435  -12.19  342.78  60.050
   P      PB      SB      SE      SN      TI      TL       Y      ZN
4.6866  .74434  36.744  -6.102  -55.90  75.739  2.6408  1.1700  .95535

MEAN    N=5     ALL2    7-JUN-88 15:20:12
  LV
5044.4
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
2321.2  13.200  -7.100  ******  13.800  42318.  6164.9  15012.  23177.  15929.
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
2150.2  .00000  4623.1  201.70  7644.3  318.40  2022.2  -3672.  473.10  -9.600
   P      PB      SB      SE      SN      TI      TL       Y      ZN
5308.4  3919.7  10089.  .00000  -.4000  51.000  13736.  5316.5  98455.

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 15:20:14
  LV
.54781
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
52.288  6.5154  12.587  2028.9  4.4525  405.67  72.120  151.28  191.48  91.640
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
37.823  .00000  16.846  100.67  31.292  12.987  7.8947  15.415  83.471  12.193
   P      PB      SB      SE      SN      TI      TL       Y      ZN
243.15  28.563  108.46  .00000  .22361  10.977  107.34  62.331  854.46

DETECTION LIMIT         N=5     ALL2    7-JUN-88 15:20:17
  LV
1.0956
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
104.58  13.031  25.173  4057.7  8.9051  811.33  144.24  302.56  382.95  183.28
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
75.646  .00000  33.693  201.34  62.584  25.975  15.789  30.829  166.94  24.386
   P      PB      SB      SE      SN      TI      TL       Y      ZN
486.31  57.126  216.93  .00000  .44721  21.955  214.69  124.66  1708.9

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:20:21
  LV
.01086
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
2.2526  49.359  -177.3  .29669  32.265  .95861  1.1699  1.0077  .82614  .57530
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
1.7590  .00000  .36440  49.911  .40935  4.0790  .39040  -.4198  17.643  -127.0
   P      PB      SB      SE      SN      TI      TL       Y      ZN
4.5806  .72870  1.0751  .00000  -55.90  21.524  .78145  1.1724  .86787
SAT>PC
ENTER SAMPLE NAME>1PPM
ENTER CLASS NAME>MRI2A
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>
```

```
MEAN     N=5      ALL2     7-JUN-88 15:23:11
BLANK SUBTRACTED
  LV
5044.7
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-.0101   1.0185   1.0940   .56149   1.0063   .00002   .00102   .01165   .00876   .04268
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.3136   .00000   .78397   1.0426   1.8260   1.8813   .90649   1.0122   .99300   1.0045
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-.0139   .00474   1.1056   -.0065   24.999   .99378   .04708   .00164   .01256

STANDARD DEVIATION        N=5      ALL2     7-JUN-88 15:23:15
BLANK SUBTRACTED
  LV
.57000
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.01237   .02806   .03263   1.2387   .00598   .00008   .00068   .00134   .00059   .00330
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.00917   .00000   .02986   .01221   .21761   .01112   .00474   .00352   .01640   .00890
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.01073   .01980   .03423   .00014   .00282   .00639   .02324   .00090   .00067

DETECTION LIMIT           N=5      ALL2     7-JUN-88 15:23:25
BLANK SUBTRACTED
  LV
1.1400
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.02474   .05612   .06527   2.4774   .01195   .00017   .00135   .00267   .00117   .00661
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.01833   .00000   .05972   .02443   .43523   .02224   .00949   .00704   .03280   .01780
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.02146   .03959   .06845   .00029   .00565   .01278   .04649   .00180   .00133

% RELATIVE STANDARD DEVIATION   N=5      ALL2     7-JUN-88 15:23:38
BLANK SUBTRACTED
  LV
.01130
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-122.1   2.7548   2.9829   220.61   .59391   516.50   66.347   11.477   6.6913   7.7381
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-2.923   .00000   3.8086   1.1715   11.917   .59114   .52318   .34787   1.6516   .88590
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-77.15   417.46   3.0956   -2.212   .01130   .64306   49.373   54.986   5.3099

MEAN     N=5      ALL2     7-JUN-88 15:23:53
  LV
5044.7
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-3.200   197.30   401.90   ******   5514.4   816.10   136.90   145.80   5640.0   8071.5
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-668.8   .00000   4474.9   10788.   7712.5   38946.   35577.   3964.8   3379.2   5702.4
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-101.6   109.00   12964.   .00000   .50000   7475.6   9859.4   -1.400   9666.2
```

```
STANDARD DEVIATION       N=5     ALL2    7-JUN-88 15:23:56
  LV
.57000
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
28.084   5.2273   12.537   9996.8   32.191   4.2633   4.0988   19.508   9.8240   26.910
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
19.460   .00000   7.3262   124.48   15.804   224.65   172.00   25.929   48.251   50.157
  P        PB       SB       SE       SN       TI       TL       Y        ZN
166.24   71.429   98.460   .00000   .00000   47.113   89.053   4.8399   40.355

DETECTION LIMIT          N=5     ALL2    7-JUN-88 15:23:59
  LV
1.1400
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
56.168   10.455   25.074   19994.   64.383   8.5266   8.1975   39.017   19.648   53.820
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
38.920   .00000   14.652   248.96   31.607   449.31   344.00   51.859   96.503   100.31
  P        PB       SB       SE       SN       TI       TL       Y        ZN
332.48   142.86   196.92   .00000   .00000   94.226   178.11   9.6799   80.710

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:24:02
  LV
.01130
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-877.6   2.6494   3.1194   1.4892   .58377   .52240   2.9940   13.380   .17418   .33339
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-2.910   .00000   .16372   1.1539   .20491   .57683   .48345   .65399   1.4279   .87957
  P        PB       SB       SE       SN       TI       TL       Y        ZN
-163.6   65.531   .75952   .00000   .00000   .63023   .90323   -345.7   .41749
SAT>PC
ENTER SAMPLE NAME>INTF
ENTER CLASS NAME>CKSTD
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 15:26:42
BLANK SUBTRACTED
  LV
5045.0
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.92622   100.18   1.9589   12.794   .99858   .83344   77.072   1.0260   1.0100   1.0768
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.69906   -.0000   102.07   1.0500   100.95   1.8695   .89278   .91549   99.522   1.0026
  P        PB       SB       SE       SN       TI       TL       Y        ZN
32.535   1.0486   .87757   -.7651   39.996   .99387   .98580   .98355   1.5173

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 15:26:47
BLANK SUBTRACTED
  LV
.70711
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.00748   .11656   .04094   6.5409   .00186   .00096   .73157   .00249   .00201   .00391
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.01095   .00001   .17375   .00895   .26987   .00188   .00075   .00530   .30899   .00242
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.07768   .01056   .03215   .00080   13.692   .00199   .01007   .00174   .00240
```

not used
recalibrated
later
GBM 6-17-88

```
DETECTION LIMIT          N=5     ALL2    7-JUN-88 15:26:57
BLANK SUBTRACTED
  LV
1.4142
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
.01497  .23311  .08187  13.082  .00373  .00191  1.4631  .00499  .00402  .00782
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
.02191  .00001  .34750  .01789  .53973  .00376  .00150  .01059  .61798  .00484
  P       PB      SB      SE      SN      TI      TL      Y       ZN
.15537  .02113  .06431  .00160  27.383  .00398  .02013  .00347  .00481

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:27:09
BLANK SUBTRACTED
  LV
.01402
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
.80803  .11635  2.0898  51.123  .18657  .11465  .94920  .24306  .19878  .36320
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
1.5670  -223.6  .17022  .85209  .26731  .10066  .08419  .57847  .31048  .24113
  P       PB      SB      SE      SN      TI      TL      Y       ZN
.23877  1.0075  3.6639  -.1044  34.233  .20013  1.0211  .17661  .15835

MEAN    N=5     ALL2    7-JUN-88 15:27:24
  LV
5045.0
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
2122.6  18667.  734.00  ******  5472.3  44921.  ******  14936.  23153.  16474.
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
1478.7  -.1000  28252.  10863.  14722.  38705.  35653.  3247.6  ******  5692.0
  P       PB      SB      SE      SN      TI      TL      Y       ZN
******  4569.5  13248.  .00000  .80000  7476.7  15152.  5280.0  ******

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 15:27:27
  LV
.70711
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
16.806  20.665  15.640  53053.  9.4713  44.960  4424.1  35.484  32.417  30.523
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
23.223  .22361  38.449  91.222  19.198  34.714  28.660  39.204  879.31  13.412
  P       PB      SB      SE      SN      TI      TL      Y       ZN
1171.4  37.751  92.652  .00000  .27386  13.940  37.704  8.8600  142.31

DETECTION LIMIT          N=5     ALL2    7-JUN-88 15:27:30
  LV
1.4142
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
33.611  41.331  31.281  ******  18.943  89.920  8848.3  70.968  64.834  61.045
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
46.446  .44721  76.897  182.44  38.396  69.427  57.320  78.407  1758.6  26.823
  P       PB      SB      SE      SN      TI      TL      Y       ZN
2342.8  75.502  185.30  .00000  .54772  27.881  75.409  17.720  284.62
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:27:34
  LV
.01402
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.79174   .11070   2.1309   9.2731   .17308   .10009   .94591   .23758   .14001   .18528
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
1.5705   -223.6   .13609   .83976   .13041   .08969   .08039   1.2072   .29892   .23562
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.23231   .82615   .69938   .00000   34.233   .18645   .24883   .16780   .13994
SAT>PC
ENTER SAMPLE NAME>5PPM
ENTER CLASS NAME>MRI5
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5     ALL2    7-JUN-88 15:30:03
BLANK SUBTRACTED
  LV
5044.6
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
5.0816   -.0542   .01407   1.7185   .00112   4.0328   4.9693   5.1380   5.1202   5.1087
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
5.0530   .00000   5.8026   .00781   .16051   .00006   .00102   -.0296   .03034   .00661
  P        PB       SB       SE       SN       TI       TL       Y        ZN
1.6680   5.2512   .11483   -.0223   -9.999   .00183   5.2944   5.0556   7.5420

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 15:30:07
BLANK SUBTRACTED
  LV
.82179
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.01478   .03490   .02015   .65095   .00045   .01391   .02074   .01269   .00781   .03228
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.02116   .00000   .05787   .00568   .14708   .00020   .00011   .00404   .01259   .00298
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.01637   .01975   .01369   .00013   13.691   .00070   .03669   .01952   .02529

DETECTION LIMIT          N=5     ALL2    7-JUN-88 15:30:17
BLANK SUBTRACTED
  LV
1.6436
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.02955   .06980   .04030   1.3019   .00090   .02782   .04149   .02538   .01563   .06455
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.04232   .00000   .11574   .01135   .29416   .00039   .00022   .00807   .02518   .00596
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.03274   .03951   .02737   .00026   27.382   .00139   .07338   .03903   .05058
```

not used
recalibration
later
GSM
6-17-88

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:30:30
BLANK SUBTRACTED
  LV
.01629
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.29080  -64.35  143.21  37.878  40.319  .34491  .41743  .24698  .15258  .63180
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.41877  .00000  .99731  72.676  91.634  320.61  10.644  -13.63  41.489  45.134
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.98129  .37618  11.919  -.5778  -136.9  38.081  .69295  .38601  .33533

MEAN    N=5     ALL2    7-JUN-88 15:30:45
  LV
5044.6
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
11556.  -2.500  -12.70  ******  16.400  ******  30276.  74889.  93786.  49227.
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
10711.  .00000  5652.8  271.60  7594.6  313.70  2042.4  -3766.  538.30  7.8000
   P      PB      SB      SE      SN      TI      TL       Y      ZN
25958.  18984.  10134.  .00000  -.2000  50.200  29983.  27180.  ******

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 15:30:48
  LV
.82179
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
32.918  6.5000  7.7347  5179.6  2.4597  676.93  122.05  173.45  125.15  257.04
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
43.688  .00000  13.198  57.688  10.986  4.0404  4.0837  30.090  37.153  17.017
   P      PB      SB      SE      SN      TI      TL       Y      ZN
250.24  68.267  38.630  .00000  .27386  5.2154  138.07  101.54  1461.1

DETECTION LIMIT         N=5     ALL2    7-JUN-88 15:30:51
  LV
1.6436
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
65.836  13.000  15.469  10359.  4.9194  1353.9  244.10  346.90  250.30  514.07
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
87.375  .00000  26.397  115.38  21.972  8.0808  8.1674  60.181  74.305  34.034
   P      PB      SB      SE      SN      TI      TL       Y      ZN
500.48  136.53  77.260  .00000  .54772  10.431  276.13  203.08  2922.3
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:30:54
  LV
.01629
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.28486   -260.0   -60.90   .78256   14.998   .33045   .40313   .23161   .13344   .52215
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.40786   .00000   .23348   21.240   .14466   1.2880   .19995   -.7990   6.9019   218.17
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.96401   .35960   .38120   .00000   -136.9   10.389   .46047   .37359   .31546
SAT>PC
ENTER SAMPLE NAME>10PPM
ENTER CLASS NAME>RMI5
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5     ALL2     7-JUN-88 15:35:16
BLANK SUBTRACTED
  LV
5043.9
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
10.196   -.1509   .05158   3.9962   .00110   7.8067   9.9801   10.342   10.294   10.177
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
10.144   .00000   11.797   .00082   .61681   .00038   .00211   -.0401   .03701   .01236
  P        PB       SB       SE       SN       TI       TL       Y        ZN
3.3438   10.530   .15683   -.0450   -35.00   .00219   10.639   10.224   12.601

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 15:35:21
BLANK SUBTRACTED
  LV
.54792
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.03053   .03491   .02619   .36274   .00037   .01237   .02632   .02451   .04103   .04736
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.02984   .00000   .07582   .01645   .11822   .00015   .00012   .00255   .01049   .00297
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.01927   .06429   .02971   .00038   22.362   .00093   .03963   .03642   .02861

DETECTION LIMIT          N=5      ALL2    7-JUN-88 15:35:31
BLANK SUBTRACTED
  LV
1.0958
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.06106   .06981   .05239   .72549   .00074   .02474   .05264   .04903   .08205   .09473
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.05968   .00000   .15164   .03290   .23645   .00030   .00024   .00510   .02099   .00593
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.03855   .12857   .05942   .00075   44.723   .00185   .07926   .07283   .05722

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:35:44
BLANK SUBTRACTED
  LV
.01086
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.29940   -23.13   50.781   9.0772   33.624   .15848   .26374   .23702   .39854   .46542
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.29419   .00000   .64271   2010.8   19.167   39.043   5.7772   -6.365   28.355   24.014
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.57639   .61048   18.945   -.8349   -63.88   42.266   .37250   .35619   .22704
```

needs recalibration – this std been set used for recalibration 6-17-88

```
MEAN     N=5      ALL2    7-JUN-88 15:35:59
  LV
5043.9
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
23164.  -20.50   1.7000   ******   16.300   ******   60664.   ******   ******   90387.
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
21504.  .00000   7058.9   200.50   7625.8   320.30   2106.0   -3843.   557.90   40.600
   P       PB       SB       SE       SN       TI       TL        Y       ZN
51916.  37980.   10270.   .00000   -.7000   52.900   50488.   54969.   ******

STANDARD DEVIATION         N=5      ALL2    7-JUN-88 15:36:02
  LV
.34792
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
70.345  6.5000   10.054   2970.3   2.0187   610.35   158.50   353.58   702.34   382.27
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
63.138  .00000   18.143   167.14   7.7833   3.0537   4.6368   19.022   31.005   16.931
   P       PB       SB       SE       SN       TI       TL        Y       ZN
297.81  232.55   84.644   .00000   .44721   6.9318   149.18   195.11   1687.4

DETECTION LIMIT            N=5      ALL2    7-JUN-88 15:36:05
  LV
1.0958
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
140.69  13.000   20.107   5940.6   4.0373   1220.7   317.00   707.16   1404.7   764.53
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
126.28  .00000   36.286   334.28   15.567   6.1075   9.2736   38.043   62.010   33.863
   P       PB       SB       SE       SN       TI       TL        Y       ZN
595.61  465.10   169.29   .00000   .89443   13.864   298.35   390.23   3374.9

% RELATIVE STANDARD DEVIATION   N=5      ALL2    7-JUN-88 15:36:08
  LV
.01086
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
.30369  -31.71   591.39   .46171   12.384   .15423   .26127   .23455   .38380   .42292
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.29361  .00000   .25702   83.363   .10207   .95340   .22017   -.4949   5.5574   41.703
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.57362  .61230   .82420   .00000   -63.89   13.104   .29547   .35495   .21976
BAT>NS
ENTER STANDARD NAME>MRI5
BAT>SSWA
ENTER VALUE(S)>
HIGH STD VALUES MISSING FOR LCN:7
HIGH STD VALUES MISSING FOR LCN:13
HIGH STD VALUES MISSING FOR LCN:17
HIGH STD VALUES MISSING FOR LCN:25
LOW STD VALUE = 0 FOR LCN:26
HIGH STD VALUES MISSING FOR LCN:30
BAT>PC
ENTER SAMPLE NAME>1PPM
ENTER CLASS NAME>MRI1A
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>
```

→ recalibration sequence for Pb, Cd, Cr & all other mass elements MC 17:58

```
MEAN     N=5     ALL2    7-JUN-88 15:39:32
BLANK SUBTRACTED
  LV
5044.9
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.99873   .02094   .01199   -.5187   .00088   .82632   .99400   1.0098   1.0053   .99854
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.99811   .00000   1.4508   .00398   1.4129   -.0003   .00122   -.0348   .00678   .00373
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.32935   1.0411   .17859   -.0056   -25.00   .00176   1.0673   .97157   1.5184

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 15:39:37
BLANK SUBTRACTED
  LV
.65125
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.00797   .05318   .01817   .69493   .00044   .00397   .00574   .00682   .00491   .00513
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.00767   .00000   .07953   .00442   .39742   .00027   .00022   .00328   .02659   .00394
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.00506   .01935   .02526   .00052   .00323   .00086   .02281   .00564   .00727

DETECTION LIMIT          N=5     ALL2    7-JUN-88 15:39:47
BLANK SUBTRACTED
  LV
1.3025
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.01593   .10637   .03633   1.3899   .00087   .00795   .01148   .01365   .00982   .01026
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.01533   .00000   .15907   .00883   .79485   .00055   .00044   .00656   .05319   .00788
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.01012   .03869   .05052   .00104   .00647   .00172   .04563   .01127   .01453

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:39:59
BLANK SUBTRACTED
  LV
.01291
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.79754   254.03   151.53   -134.0   49.649   .48082   .57730   .67562   .48833   .51364
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.76813   .00000   5.4822   110.89   28.128   -102.9   18.100   -9.422   392.20   105.60
  P        PB       SB       SE       SN       TI       TL       Y        ZN
1.5362   1.8584   14.145   -9.263   -.0129   48.728   2.1376   .58005   .47855

MEAN     N=5     ALL2    7-JUN-88 15:40:15
  LV
5044.9
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
2328.5   11.500   -13.50   ******   15.100   42617.   6149.1   15203.   23340.   15983.
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
2137.5   .00000   4631.6   232.70   7683.6   307.00   2033.1   -3805.   468.80   -8.600
  P        PB       SB       SE       SN       TI       TL       Y        ZN
5217.1   4028.9   10305.   -.1000   -.5000   49.700   14055.   5331.8   ******
```

```
STANDARD DEVIATION      N=5     ALL2    7-JUN-88 15:40:17
  LV
.65125
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
18.211   9.9058   6.9732   5679.0   2.3822   201.33   34.697   103.01   86.936   43.439
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
16.504   .00000   18.609   44.891   28.145   5.6236   8.4291   24.317   78.481   22.498
   P       PB       SB       SE       SN       TI       TL        Y       ZN
78.414   73.501   72.485   .22361   .00000   6.4285   94.979   30.967   439.48

DETECTION LIMIT         N=5     ALL2    7-JUN-88 15:40:20
  LV
1.3025
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
36.421   19.812   13.946   11358.   4.7645   402.67   69.394   206.03   173.87   86.878
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
33.008   .00000   37.218   89.782   56.291   11.247   16.858   48.634   156.96   44.997
   P       PB       SB       SE       SN       TI       TL        Y       ZN
156.83   147.00   144.97   .44721   .00000   12.857   189.96   61.934   878.97

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:40:24
  LV
.01291
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.78207   86.137   -51.65   .83507   15.776   .47243   .56427   .67757   .37247   .27178
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.77211   .00000   .40178   19.291   .36630   1.8318   .41459   -.6391   16.741   -261.6
   P       PB       SB       SE       SN       TI       TL        Y       ZN
1.5030   1.8243   .70342   -223.6   .00000   12.935   .67576   .58079   .43789
SAT>PC
ENTER SAMPLE NAME>INTF
ENTER CLASS NAME>CKSTD
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 15:43:12
BLANK SUBTRACTED
  LV
5044.9
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.89644   100.51   1.9756   13.207   1.0019   .84051   77.347   1.0056   .99478   1.0718
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.68464   .00001   103.04   1.0758   102.28   1.8829   .89934   .93428   99.297   1.0103
   P       PB       SB       SE       SN       TI       TL        Y       ZN
33.260   1.0203   1.0019   -.7699   -25.00   .99914   .91185   .96532   1.5456
```

```
STANDARD DEVIATION       N=5     ALL2    7-JUN-88 15:43:17
BLANK SUBTRACTED
  LV
.96106
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.01166   .31202   .01097   6.0416   .00275   .00243   .43092   .00229   .00304   .00557
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.00860   .00001   .25193   .00589   .23620   .00615   .00317   .00441   .46054   .00708
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.12957   .00759   .03336   .00225   17.672   .00314   .02595   .00315   .00668

DETECTION LIMIT          N=5     ALL2    7-JUN-88 15:43:27
BLANK SUBTRACTED
  LV
1.9221
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.02333   .62404   .02194   12.083   .00550   .00486   .86184   .00459   .00608   .01114
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.01720   .00003   .50386   .01178   .47240   .01230   .00634   .00883   .92108   .01415
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.25914   .01519   .06671   .00451   35.345   .00627   .05190   .00630   .01337

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:43:39
BLANK SUBTRACTED
  LV
.01905
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
1.3010   .31044   .55519   45.744   .27451   .28932   .55712   .22815   .30543   .51948
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
1.2561   136.93   .24449   .54768   .23094   .32656   .35274   .47251   .46380   .70052
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.38956   .74432   3.3292   -.2927   -70.70   .31397   2.8461   .32617   .43237

MEAN     N=5     ALL2    7-JUN-88 15:43:55
  LV
5044.9
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
2092.0   18728.   740.40   ******   5490.5   45297.   ******   15139.   23410.   16590.
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
1464.8   .40000   28479.   11126.   14815.   38981.   35900.   3387.0   ******   5735.8
   P       PB       SB       SE       SN       TI       TL        Y       ZN
******   4700.2   13608.   -.2000   -.5000   7516.0   15250.   5297.4   ******

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 15:43:57
  LV
.96106
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
27.090   59.255   4.2190   48952.   15.504   129.72   2684.3   33.588   57.610   48.222
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
18.536   .54772   61.006   58.721   18.712   128.91   120.23   33.051   1359.4   39.985
   P       PB       SB       SE       SN       TI       TL        Y       ZN
2073.5   28.536   95.350   .27386   .35355   24.145   103.22   17.876   409.83
```

```
DETECTION LIMIT          N=5     ALL2    7-JUN-88 15:44:01
  LV
1.9221
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
54.180   118.51   8.4380   97904.   31.008   259.45   5368.5   67.175   115.22   96.444
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
37.072   1.0954   122.01   117.44   37.423   257.82   240.45   66.102   2718.8   79.971
  P        PB       SB       SE       SN       TI       TL       Y        ZN
4147.0   57.072   190.70   .54772   .70711   48.291   206.44   35.751   819.65

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:44:04
  LV
.01905
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
1.2949   .31640   .56982   8.6069   .28238   .28639   .57301   .22187   .24609   .29065
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
1.2654   136.93   .21421   .52780   .12630   .33070   .33490   .97582   .46317   .69712
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.40225   .60712   .70067   -136.9   -70.71   .32125   .67685   .33744   .39632
BAT>PC
ENTER SAMPLE NAME>SPPM
ENTER CLASS NAME>MRIS
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 15:46:52
BLANK SUBTRACTED
  LV
5045.5
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
4.9952   -.0542   .02449   2.2933   .00143   4.0461   4.9718   5.0223   5.0129   5.0368
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
4.9895   .00000   6.0190   -.0001   1.0082   .00009   .00148   -.0417   .02899   .00636
  P        PB       SB       SE       SN       TI       TL       Y        ZN
1.6869   5.0824   .17481   -.0229   -25.00   .00236   5.1222   4.9527   7.6562

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 15:46:56
BLANK SUBTRACTED
  LV
1.3693
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.01608   .02809   .01662   1.0591   .00051   .02009   .02708   .02117   .02313   .02213
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.03173   .00000   .05258   .00976   .15715   .00008   .00020   .00342   .00538   .00304
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.01246   .03746   .02620   .00021   .00678   .00043   .06514   .02821   .03800

DETECTION LIMIT          N=5     ALL2    7-JUN-88 15:47:07
BLANK SUBTRACTED
  LV
2.7386
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.03215   .05618   .03324   2.1183   .00101   .04018   .05417   .04234   .04626   .04425
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.06345   .00000   .10516   .01951   .31429   .00015   .00041   .00683   .01076   .00607
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.02492   .07492   .05239   .00042   .01357   .00086   .13029   .05641   .07601
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:47:19
BLANK SUBTRACTED
  LV
.02714
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.32182  -51.79   67.853   46.185   35.565   .49656   .54474   .42155   .46139   .43929
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.63588  .00000   .87359   -7336.   15.586   85.771   13.686   -8.191   18.562   47.708
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.73860  .73707   14.986   -.9242   -.0271   18.123   1.2718   .56950   .49637

MEAN    N=5     ALL2    7-JUN-88 15:47:35
  LV
5045.5
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
11570.  -2.500   -8.700   ******   18.100   ******   30237.   75717.   94521.   49386.
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
10704.  .00000   5704.6   190.90   7655.9   314.30   2060.9   -3856.   534.40   6.4000
   P       PB       SB       SE       SN       TI       TL        Y       ZN
26255.  19343.   10308.   .10000   -.5000   54.200   30704.   27225.   ******

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 15:47:37
  LV
1.3693
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
36.666  5.2321   6.3797   8626.6   2.7704   995.00   160.53   312.17   394.99   177.46
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
67.693  .00000   12.521   99.165   12.929   1.5248   7.4867   25.128   15.742   17.318
   P       PB       SB       SE       SN       TI       TL        Y       ZN
189.47  141.58   72.990   .22361   .00000   3.2133   267.76   152.66   2236.2

DETECTION LIMIT         N=5     ALL2    7-JUN-88 15:47:41
  LV
2.7386
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
73.332  10.464   12.759   17253.   5.5408   1990.0   321.06   624.35   789.98   354.93
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
135.39  .00000   25.042   198.33   25.859   3.0496   14.973   50.256   31.483   34.637
   P       PB       SB       SE       SN       TI       TL        Y       ZN
378.94  283.15   145.98   .44721   .00000   6.4265   535.52   305.32   4472.4

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:47:44
  LV
.02714
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.31690  -209.3   -73.33   1.3124   15.306   .48405   .53091   .41229   .41789   .35934
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.63239  .00000   .21949   51.946   .16888   .48513   .36327   -.6516   2.9457   270.60
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.72167  .73191   .70809   223.61   .00000   5.9285   .87207   .56074   .47564
SAT>PC
ENTER SAMPLE NAME>10PPM
ENTER CLASS NAME>MRI5
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>
```

```
MEAN      N=5      ALL2     7-JUN-88 15:50:38
BLANK SUBTRACTED
  LV
5044.5
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
9.9712   -.1407    .02866    1.3971    .00148    7.8129    9.9799    9.9864    9.9985    9.9633
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
9.9745   .00000    11.757   -.0035     .59972    .00065    .00211   -.0520     .04573    .01239
  P         PB        SB        SE        SN        TI        TL        Y         ZN
3.4097   10.132    .20076   -.0450    -35.00     .00226    10.196    9.9866    12.680

STANDARD DEVIATION       N=5      ALL2     7-JUN-88 15:50:43
BLANK SUBTRACTED
  LV
.35269
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
.05423   .03414    .03590    3.6016    .00055    .02190    .05695    .05338    .05678    .0579
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
.06683   .00000    .04900    .00870    .27839    .00038    .00021    .00331    .02193    .0044
  P         PB        SB        SE        SN        TI        TL        Y         ZN
.02358   .05305    .04632    .00026    22.360    .00074    .10366    .07523    .04151

DETECTION LIMIT          N=5      ALL2     7-JUN-88 15:50:53
BLANK SUBTRACTED
  LV
.70538
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
.10846   .06829    .07179    7.2033    .00110    .04381    .11390    .10676    .11355    .11572
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
.13366   .00000    .09799    .01740    .55677    .00076    .00042    .00662    .04386    .00891
  P         PB        SB        SE        SN        TI        TL        Y         ZN
.04715   .10611    .09263    .00052    44.721    .00148    .20733    .15045    .08303

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:51:06
BLANK SUBTRACTED
  LV
.00699
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
.54389   -24.27    125.26    257.79    37.130    .28037    .57063    .53455    .56784    .58077
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
.66996   .00000    .41672   -246.8     46.420    58.652    10.040   -6.364     47.953    35.973
  P         PB        SB        SE        SN        TI        TL        Y         ZN
.69147   .52364    23.070   -.5769    -63.89     32.830    1.0167    .75327    .32740

MEAN      N=5      ALL2     7-JUN-88 15:51:21
  LV
5044.5
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
23072.   -18.60    -7.100    ******    18.400    ******    60551.    ******    ******    90116.
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
21399.   .00000    7050.4    156.40    7625.5    325.70    2106.1   -3932.     583.70    40.800
  P         PB        SB        SE        SN        TI        TL        Y         ZN
52943.   38469.    10397.   -.1000    -.7000     53.400    51525.    54896.    ******
```

```
STANDARD DEVIATION       N=5      ALL2    7-JUN-88 15:51:24
  LV
.35269
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
124.96   6.3581   13.781   29198.   3.0083   1098.7   342.30   802.45   1004.2   473.69
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
142.56   .00000   11.189   88.396   20.068   7.7830   7.8850   24.360   64.728   25.438
   P       PB       SB       SE       SN       TI       TL        Y       ZN
365.72   200.83   132.42   .22361   .44721   5.5498   423.89   411.86   2481.2

DETECTION LIMIT          N=5      ALL2    7-JUN-88 15:51:27
  LV
.70538
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
249.91   12.716   27.563   58397.   6.0166   2197.5   684.59   1604.9   2008.4   947.38
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
285.12   .00000   22.378   176.79   40.136   15.566   15.770   48.721   129.46   50.875
   P       PB       SB       SE       SN       TI       TL        Y       ZN
731.45   401.67   264.84   .44721   .89443   11.100   847.78   823.71   4962.5

% RELATIVE STANDARD DEVIATION   N=5      ALL2    7-JUN-88 15:51:31
  LV
.00699
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.54156   -34.18   -194.1   4.3943   16.350   .27738   .56530   .53301   .54864   .52565
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.66620   .00000   .15870   56.519   .26317   2.3896   .37439   -.6195   11.089   62.347
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.69079   .52207   1.2737   -223.6   -63.89   10.393   .82268   .75025   .32113
SAT>PC
ENTER SAMPLE NAME>5PPM
ENTER CLASS NAME>MRI6A
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5      ALL2    7-JUN-88 15:54:02
BLANK SUBTRACTED
  LV
5045.1
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-.1150   4.9402   5.6231   2.3413   4.9721   .00297   .01312   .05011   .02676   .17515
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-1.619   .00000   3.0317   5.4574   5.3404   9.7903   4.6541   5.2746   4.8635   5.0291
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-.0251   .01157   5.4193   -.0287   24.997   4.9465   .11732   .00563   .05508

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 15:54:06
BLANK SUBTRACTED
  LV
.65190
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.02821   .06569   .04288   6.5763   .00655   .00393   .01129   .00483   .00496   .00712
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.01952   .00000   .09049   .03845   .24865   .01779   .01247   .01515   .02318   .01919
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.01230   .01686   .02161   .00053   .00323   .00731   .01335   .00574   .00755
```

```
DETECTION LIMIT          N=5      ALL2     7-JUN-88 15:54:17
BLANK SUBTRACTED
  LV
1.3038
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.05642   .13138   .08576   13.153   .01310   .00787   .02258   .00966   .00992   .01425
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.03904   .00000   .18097   .07691   .49730   .03557   .02493   .03030   .04635   .03838
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.02460   .03372   .04322   .00105   .00646   .01461   .02669   .01147   .01510

% RELATIVE STANDARD DEVIATION   N=5      ALL2     7-JUN-88 15:54:29
BLANK SUBTRACTED
  LV
.01292
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-24.53   1.3297   .76259   280.88   .13174   132.29   86.013   9.6438   18.534   4.0665
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-1.206   .00000   2.9847   .70460   4.6559   .18168   .26785   .28725   .47652   .38156
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-49.03   145.72   .39880   -1.832   .01292   .14769   11.376   101.96   13.710

MEAN     N=5      ALL2     7-JUN-88 15:54:45
  LV
5045.1
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-246.6   927.80   2140.9   ******   27207.   1009.2   210.20   731.30   5971.7   9174.3
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-3479.   .00000   5002.9   55657.   7961.6   ******   ******   35599.   14803.   28672.
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-274.8   164.80   25351.   .30000   .50000   37067.   10217.   20.600   12266.

STANDARD DEVIATION       N=5      ALL2     7-JUN-88 15:54:47
  LV
.65190
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
65.186   12.332   16.589   53368.   35.842   198.89   68.369   72.939   88.643   59.838
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
41.757   .00000   21.741   394.62   18.119   383.66   476.55   114.87   70.248   112.92
   P       PB       SB       SE       SN       TI       TL        Y       ZN
190.56   64.286   61.727   .44721   .00000   56.598   56.719   31.538   455.80

DETECTION LIMIT          N=5      ALL2     7-JUN-88 15:54:51
  LV
1.3038
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
130.37   24.664   33.177   ******   71.684   397.78   136.74   145.88   177.29   119.68
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
83.513   .00000   43.482   789.25   36.239   767.32   953.11   229.73   140.50   225.84
   P       PB       SB       SE       SN       TI       TL        Y       ZN
381.12   128.57   123.45   .89443   .00000   113.20   113.44   63.077   911.60
```

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% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:54:54
  LV
.01292
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-26.43   1.3292   .77484   8.1243   .13174   19.708   32.526   9.9739   1.4844   .65223
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-1.200   .00000   .43457   .70903   .22758   .19052   .27313   .32267   .47457   .39384
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-69.35   39.009   .24349   149.07   .00000   .15269   .55514   153.10   3.7159
SAT>PC
ENTER SAMPLE NAME>10PPM
ENTER CLASS NAME>MRI6A
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 15:57:36
BLANK SUBTRACTED
  LV
5045.8
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-.2550   9.8576   11.249   10.549   10.049   -.0008   .00972   .09103   .04070   .34592
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-3.274   .00000   6.0477   11.023   10.245   19.164   9.8338   10.623   9.7408   10.079
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-.0367   -.0069   10.718   -.0575   9.9960   9.9962   .13402   .00161   .09569

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 15:57:40
BLANK SUBTRACTED
  LV
.75814
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.01211   .02446   .08753   .62709   .02872   .00005   .00019   .00154   .00106   .00392
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.02477   .00001   .07797   .05053   .40411   .02161   .04012   .03026   .01722   .02543
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.00739   .01922   .06899   .00023   22.355   .03010   .01213   .00033   .00081

DETECTION LIMIT         N=5     ALL2    7-JUN-88 15:57:50
BLANK SUBTRACTED
  LV
1.5163
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.02423   .04893   .17506   1.2542   .05743   .00010   .00038   .00308   .00212   .00784
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.04953   .00002   .15595   .10106   .80822   .04323   .08024   .06052   .03443   .05085
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.01479   .03843   .13798   .00047   44.709   .06020   .02426   .00067   .00162

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 15:58:03
BLANK SUBTRACTED
  LV
.01503
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-4.750   .24816   .77812   5.9444   .28576   -6.954   1.9436   1.6936   2.6057   1.1326
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.7564   223.61   1.2893   .45838   3.9446   .11279   .40797   .28487   .17674   .25227
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-20.14   -279.2   .64370   -.4074   223.63   .30110   9.0488   20.794   .84756
```

not needed will not recalibrate GJm 6-7-88

```
MEAN     N=5      ALL2    7-JUN-88 15:58:19
  LV
3045.8
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
-576.5  1644.0   4301.6   ******   54987.   979.20   189.60   1348.6   6228.8   10588.
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-7031.  .20000   5711.7   ******   8309.5   ******   ******   75303.   29201.   57501.
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-454.7  131.60   40571.   .00000   .20000   74881.   10352.   -1.500   14764.

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 15:58:21
  LV
.75814
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
27.935  4.6234   33.948   5099.4   161.01   3.5109   1.1402   23.085   19.681   32.498
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
22.455  .44721   18.583   528.45   28.957   458.08   1495.5   233.04   53.904   152.14
   P       PB       SB       SE       SN       TI       TL        Y       ZN
114.52  72.989   203.46   .35355   .44721   229.07   49.362   1.8371   49.544

DETECTION LIMIT          N=5      ALL2    7-JUN-88 15:58:24
  LV
1.5163
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
55.870  9.2468   67.895   10199.   322.02   7.0216   2.2804   46.171   39.361   64.995
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
104.91  .89443   37.166   1056.9   57.914   916.17   2991.0   466.09   107.81   304.28
   P       PB       SB       SE       SN       TI       TL        Y       ZN
229.05  145.98   406.93   .70711   .89443   458.15   98.725   3.6742   99.088

% RELATIVE STANDARD DEVIATION   N=5      ALL2    7-JUN-88 15:58:28
  LV
.01503
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
-4.897  .25073   .78918   .86370   .29282   .39932   .60138   1.7118   .31596   .30693
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.7460  223.61   .32535   .47083   .34848   .11628   .40806   .30947   .18460   .26459
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-25.19  55.463   .50150   .00000   223.61   .30592   .47683   -122.5   .33557
BAT>FC
ENTER SAMPLE NAME>75PPM
ENTER CLASS NAME>MRI7
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5      ALL2    7-JUN-88 16:01:02
BLANK SUBTRACTED
  LV
5046.6
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
.03130  74.112   .66059   10.368   .00316   .02109   72.136   -.0068   .00240   .03062
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.01874  .00000   75.993   .01970   75.981   .00394   -.0026   -.1214   73.545   .00386
   P       PB       SB       SE       SN       TI       TL        Y       ZN
25.151  .02929   .05402   -.5759   -4.998   .00351   -.0050   -.0159   .01169
```

```
STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:01:07
BLANK SUBTRACTED
  LV
.65190
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
.01279   .36519    .03552    2.4058    .00048    .00018    .13411    .00250    .00037    .00292
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
.00724   .00000    .38445    .00683    .48611    .00063    .00029    .00486    .39993    .00131
  P         PB        SB        SE        SN        TI        TL        Y         ZN
.01291   .01443    .01239    .00269    11.175    .00092    .02985    .00117    .00047

DETECTION LIMIT         N=5     ALL2    7-JUN-88 16:01:17
BLANK SUBTRACTED
  LV
1.3038
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
.02559   .73039    .07104    4.8117    .00095    .00037    .26822    .00501    .00073    .00584
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
.01447   .00000    .76891    .01366    .97222    .00125    .00058    .00973    .79986    .00263
  P         PB        SB        SE        SN        TI        TL        Y         ZN
.02581   .02886    .02478    .00539    22.350    .00184    .05971    .00233    .00093

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:01:[illegible]
BLANK SUBTRACTED

[illegible]
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
[illegible] .49276  5.3767    23.205    15.082    .86610    .13591    -36.73    15.239    9.5407
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
[illegible] .00000  .50591    34.669    .63978    15.861    -11.31    -4.006    .54379    34.076
  P         PB        SB        SE        SN        TI        TL        Y         ZN
[illegible] 49.275  22.933    -.4679    -223.6    26.179    -595.6    -7.344    3.9923

MEAN    N=5     ALL2    7-JUN-88 16:01:43
  LV
[illegible]048.6
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
71.700   13816.    235.60    ******    27.600    3335.8    ******    -127.2    5722.9    7981.3
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
33.800   .00000    22137.    392.60    12960.    393.60    2324.0    -4449.    ******    -7.900
  P         PB        SB        SE        SN        TI        TL        Y         ZN
******   748.50    10650.    .20000    -.1000    62.900    11019.    -97.70    10651.

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:01:48
  LV
.65190
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
29.590   67.241    13.617    19465.    2.6077    14.657    807.70    37.777    7.3261    23.682
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
15.535   .00000    89.611    69.413    34.074    12.847    10.920    36.576    1170.0    7.5031
  P         PB        SB        SE        SN        TI        TL        Y         ZN
2201.8   56.294    38.333    .27386    .22361    6.8793    126.33    6.4187    29.526
```

```
DETECTION LIMIT         N=5     ALL2    7-JUN-88 16:01:51
  LV
1.3038
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
59.180  134.48  27.234  38929.  5.2154  29.313  1615.4  75.553  14.652  47.364
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
31.069  .00000  179.22  138.83  68.147  25.694  21.840  73.152  2340.0  15.007
  P       PB      SB      SE      SN      TI      TL      Y       ZN
4403.7  112.59  76.666  .54772  .44721  13.759  252.66  12.837  59.051

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:01:54
  LV
.01292
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
32.268  .48668  5.7797  3.2881  9.4481  .43937  .18481  -29.70  .12801  .29672
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
43.393  .00000  .40480  17.680  .26291  3.2640  .46989  -.8221  .53776  -94.98
  P       PB      SB      SE      SN      TI      TL      Y       ZN
.56464  7.5209  .35992  136.93  -223.6  10.954  1.1464  -6.570  .27722
SAT>FC
ENTER SAMPLE NAME>150PPM
ENTER CLASS NAME>MRI7
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 16:04:22
BLANK SUBTRACTED
  LV
5047.2
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
.02987  151.74  1.3801  -.5996  .00404  .04241  120.18  -.0151  -.0018  .05669
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
.03196  .00000  153.05  .01680  153.86  .00635  -.0062  -.2181  150.95  .00279
  P       PB      SB      SE      SN      TI      TL      Y       ZN
149.81  .03095  -.0775  -1.155  24.986  .00372  -.0783  -.0337  .01599

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:04:26
BLANK SUBTRACTED
  LV
.27368
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
.01384  .91288  .02898  .58259  .00034  .00043  .24752  .00154  .00145  .00435
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
.00717  .00001  .64592  .00864  .61885  .00032  .00034  .00217  .90399  .00469
  P       PB      SB      SE      SN      TI      TL      Y       ZN
.15549  .01260  .02347  .00566  24.985  .00073  .02373  .00118  .00064

DETECTION LIMIT         N=5     ALL2    7-JUN-88 16:04:37
BLANK SUBTRACTED
  LV
.54737
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
.02769  1.8258  .05796  1.1652  .00069  .00086  .49505  .00308  .00290  .00871
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
.01434  .00001  1.2918  .01729  1.2377  .00063  .00069  .00435  1.8080  .00937
  P       PB      SB      SE      SN      TI      TL      Y       ZN
.31098  .02520  .04694  .01132  49.970  .00147  .04746  .00237  .00129
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:04:49
BLANK SUBTRACTED
  LV
.00542
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
46.351  .60161  2.0999  -97.16  8.5226  1.0141  .20597  -10.18  -81.75  7.6794
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
22.431  223.61  .42204  51.455  .40221  4.9830  -5.532  -.9969  .59887  168.03
  P       PB      SB      SE      SN      TI      TL      Y       ZN
.10379  40.713  -30.27  -.4898  99.998  19.747  -30.31  -3.511  4.0258

MEAN    N=5     ALL2    7-JUN-88 16:05:05
  LV
3047.2
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
88.400  28283.  512.00  ******  32.400  5904.5  ******  -252.9  5844.0  8198.0
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
64.200  .10000  40235.  363.10  18470.  443.10  2635.4  -5167.  ******  -14.00
  P       PB      SB      SE      SN      TI      TL      Y       ZN
******  1334.6  11000.  .30000  .50000  64.400  12117.  -195.7  11981.

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:05:07
  LV
.27368
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
32.026  170.05  11.107  4702.9  1.8841  32.444  1486.7  23.258  24.983  36.042
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
15.393  .22361  151.84  87.877  43.874  6.5038  10.802  15.991  2667.3  26.751
  P       PB      SB      SE      SN      TI      TL      Y       ZN
2398.0  52.016  64.113  .27386  .50000  5.5045  106.32  6.5058  33.865

DETECTION LIMIT         N=5     ALL2    7-JUN-88 16:05:10
  LV
.54737
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
64.052  340.09  22.215  9405.8  3.7683  64.888  2973.4  46.516  49.966  72.083
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
30.786  .44721  303.68  175.75  87.747  13.008  21.604  31.982  5334.6  53.502
  P       PB      SB      SE      SN      TI      TL      Y       ZN
4796.1  104.03  128.23  .54772  1.0000  11.009  212.63  13.012  67.730

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:05:14
  LV
.00542
  AG      AL      AS      B       BA      BE      CA      CD      CO      CR
36.229  .60122  2.1694  .69056  5.8153  .54948  .20419  -9.196  .42750  .43964
  CU      FE      FE      HG      K       MG      MN      MO      NA      NI
23.977  223.61  .37738  24.202  .23753  1.4678  .40987  -.3095  .59787  -191.1
  P       PB      SB      SE      SN      TI      TL      Y       ZN
.10325  3.8975  .58285  91.287  100.00  8.5474  .87743  -3.324  .28265
SAT>FC
ENTER SAMPLE NAME>CAL
ENTER CLASS NAME>BLANK
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>
```

```
MEAN     N=5     ALL2    7-JUN-88 16:14:06
BLANK SUBTRACTED
  LV
5046.6
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
.02412  .03218  .03205  .01870  .00086  .00009  .00164  .00050  .00659  .00643
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.00900  .00000  .15418  .00453  .87015  .00049  .00018  -.0497  .02769  .00475
  P        PB       SB       SE       SN       TI       TL       Y        ZN
-.0016  .00466  .24815  -.0006  -24.99  .00175  .07730  .00201  .00937

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 16:14:10
BLANK SUBTRACTED
  LV
.41830
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
.00688  .02470  .00668  .55672  .00027  .00002  .00040  .00131  .00103  .00336
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.00575  .00001  .04181  .01136  .18136  .00012  .00013  .00541  .01232  .00240
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.00611  .01484  .01781  .00012  .00207  .00039  .03044  .00033  .00044

DETECTION LIMIT          N=5     ALL2    7-JUN-88 16:14:20
BLANK SUBTRACTED
  LV
.83660
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
.01377  .04939  .01335  1.1134  .00055  .00005  .00079  .00262  .00206  .00673
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.01749  .00002  .08362  .02271  .36272  .00024  .00026  .01081  .02463  .00480
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.01222  .02968  .03561  .00024  .00414  .00077  .06088  .00066  .00087

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:14:33
BLANK SUBTRACTED
  LV
.00829
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
28.535  76.740  20.828  2977.9  31.930  27.653  24.237  261.58  15.619  52.309
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
97.166  223.61  27.118  250.93  20.843  24.912  70.996  -10.88  44.472  50.573
  P        PB       SB       SE       SN       TI       TL       Y        ZN
-390.9  318.58  7.1754  -18.93  -.0083  22.177  39.380  16.522  4.6515

MEAN     N=5     ALL2    7-JUN-88 16:14:49
  LV
5046.6
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
75.100  13.600  -5.800  ******  15.000  807.90  140.70  -16.80  5606.8  7781.2
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
14.900  .20000  4328.7  238.30  7647.8  322.60  1990.2  -3917.  530.70  -2.800
  P        PB       SB       SE       SN       TI       TL       Y        ZN
59.700  102.00  10504.  .00000  -.5000  49.600  9992.5  .70000  9467.4

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 16:14:51
  LV
.41830
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
15.923  4.6016  2.5642  4496.7  1.5000  1.8843  2.4135  19.763  17.898  27.796
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
18.776  .44721  9.7382  115.43  12.347  2.5100  4.6179  40.413  36.398  13.714
  P        PB       SB       SE       SN       TI       TL       Y        ZN
94.720  56.276  50.727  .35355  .00000  2.9026  124.24  1.8235  26.291
```

```
DETECTION LIMIT          N=5     ALL2    7-JUN-88 16:14:54
  LV
.83660
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
31.846   9.2033   5.1284   8993.4   3.0000   3.7686   4.8270   39.526   35.796   55.591
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
37.553   .89443   19.476   230.87   24.695   5.0200   9.2359   90.825   72.796   27.428
  P        PB       SB       SE       SN       TI       TL       Y        ZN
189.44   112.55   101.45   .70711   .00000   5.8052   246.48   3.6469   52.582

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:14:58
  LV
.00829
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
21.203   33.836   -44.21   .66526   10.000   .23324   1.7154   -117.6   .31922   .35721
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
126.02   223.61   .22497   48.441   .16145   .77905   .23203   -1.032   6.8585   -489.8
  P        PB       SB       SE       SN       TI       TL       Y        ZN
105.60   55.173   .48294   .00000   .00000   5.8520   1.2433   260.49   .27770
SAT>PC
ENTER SAMPLE NAME>09168
ENTER CLASS NAME>STRY\Y\T
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 16:17:47
BLANK SUBTRACTED
  LV
5046.1
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.02015   .04239   .03674   21.244   .00996   .00019   .30274   .00125   .00217   -.0109
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.00700   .00000   -.0906   -.0126   -.3805   .03307   .00055   .04268   -.0064   .00464
  P        PB       SB       SE       SN       TI       TL       Y        ZN
-.0087   .01440   -.1002   .00003   .00000   .00864   -.0682   .00170   .01790

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 16:17:51
BLANK SUBTRACTED
  LV
.54770
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.01406   .03219   .03466   3.9644   .00055   .00002   .00842   .00162   .00048   .00265
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.00676   .00001   .05762   .00505   .19482   .00750   .00011   .00413   .02857   .00162
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.00974   .00931   .01839   .00022   .00000   .00099   .02500   .00094   .00034

DETECTION LIMIT          N=5     ALL2    7-JUN-88 16:18:02
BLANK SUBTRACTED
  LV
1.0954
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.02811   .06439   .06931   7.9288   .00110   .00004   .01683   .00324   .00096   .00531
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.01351   .00001   .11525   .01011   .38965   .01500   .00022   .00825   .05713   .00324
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.01947   .01861   .03678   .00043   .00000   .00199   .05001   .00187   .00069
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:18:14
BLANK SUBTRACTED
  LV
.01085
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
69.770  75.954  94.343  18.661  5.5260  11.430  2.7801  129.77  22.137  -24.27
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
96.529  223.61  -63.61  -39.98  -51.21  22.677  20.129  9.6677  -443.9  34.853
   P      PB      SB      SE      SN      TI      TL       Y      ZN
-112.1  64.617  -18.35  616.89  .00000  11.506  -36.66  55.136  1.9175

MEAN    N=5     ALL2    7-JUN-88 16:18:30
  LV
5046.1
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
65.900  15.500  -4.000  ******  64.800  808.10  1964.2  -5.500  5527.3  7636.8
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
10.600  .10000  4270.8  63.800  7558.6  991.80  2002.8  -3231.  429.90  -3.400
   P      PB      SB      SE      SN      TI      TL       Y      ZN
-20.70  139.00  9504.1  .10000  .00000  101.20  9393.2  -1.000  9977.5

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:18:32
  LV
.54770
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
32.514  6.0000  13.309  32123.  3.0125  1.3875  50.967  24.462  8.4973  22.075
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
14.502  .22361  13.609  51.376  13.469  154.03  4.2515  30.301  84.331  9.2426
   P      PB      SB      SE      SN      TI      TL       Y      ZN
150.90  35.482  52.169  .54772  .00000  7.4465  102.07  5.1478  20.090

DETECTION LIMIT         N=5     ALL2    7-JUN-88 16:18:35
  LV
1.0954
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
65.028  12.000  26.618  64246.  6.0250  2.7749  101.93  48.923  16.995  44.151
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
29.003  .44721  27.218  102.75  26.939  308.06  8.5029  60.601  168.66  18.485
   P      PB      SB      SE      SN      TI      TL       Y      ZN
301.80  70.965  104.34  1.0954  .00000  14.893  204.14  10.296  40.181

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:18:39
  LV
.01085
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
49.339  38.710  -332.7  6.3774  4.6489  .17170  2.5948  -444.8  .15373  .28907
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
136.81  223.61  .31865  80.526  .17820  15.530  .21228  -.9380  19.616  -271.8
   P      PB      SB      SE      SN      TI      TL       Y      ZN
-729.0  25.527  .54891  547.72  .00000  7.3582  1.0867  -514.8  .20136
SAT>PC
ENTER SAMPLE NAME>09169
ENTER CLASS NAME>1/10
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>
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```
MEAN    N=5     ALL2    7-JUN-88 16:21:34
BLANK SUBTRACTED
  LV
5046.2
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
-.7101  94.120  .87937  -1.225  1.5348  .00767  75.967  .03095  .12264  .39545
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
-5.869  -.0000  22.367  -.0001  14.954  20.121  1.8559  -.0906  24.935  .24517
   P      PB      SB      SE      SN      TI      TL       Y      ZN
1.6689  2.1988  .71227  -.4709  24.992  22.117  .27978  -.0000  5.5988

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:21:38
BLANK SUBTRACTED
  LV
.44683
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.00809  .46299  .03788  .27387  .00905  .00009  .20603  .00078  .00106  .00251
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.01955  .00001  .19111  .00883  .09946  .05778  .01006  .00400  .13883  .00448
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.01755  .02013  .02196  .00239  .00222  .13215  .03311  .00069  .03120

DETECTION LIMIT         N=5     ALL2    7-JUN-88 16:21:48
BLANK SUBTRACTED
  LV
.89366
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.01619  .92597  .07576  .54774  .01810  .00017  .41206  .00157  .00213  .00503
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.03911  .00001  .38222  .01766  .19891  .11555  .02012  .00800  .27767  .00897
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.03509  .04025  .04392  .00479  .00444  .26429  .06623  .00138  .06240

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:22:01
BLANK SUBTRACTED
  LV
.00885
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
-1.140  .49191  4.3075  -22.36  .58960  1.1380  .27121  2.5289  .86769  .63563
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
-.3332  -223.6  .85444  -8303.  .66508  .28714  .54200  -4.412  .55679  1.8288
   P      PB      SB      SE      SN      TI      TL       Y      ZN
1.0513  .91534  3.0828  -.5083  .00888  .59750  11.835  -5968.  .55722

MEAN    N=5     ALL2    7-JUN-88 16:22:17
  LV
5046.2
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
-1623.  17543.  319.60  ******  8407.3  1620.3  ******  442.50  7762.0  10999.
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
******  -.1000  9543.8  191.20  8643.2  ******  71036.  -4220.  74056.  1369.6
   P      PB      SB      SE      SN      TI      TL       Y      ZN
25980.  9120.4  12514.  -.2000  .50000  ******  11652.  -10.40  ******
```

```
STANDARD DEVIATION       N=5      ALL2    7-JUN-88 16:22:19
  LV
.44683
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
18.615   86.692   14.523   2231.0   49.700   7.1903   1212.0   11.800   19.564   21.125
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
41.678   .22361   45.167   89.765   7.6939   1199.1   374.79   29.785   412.01   25.567
   P       PB       SB       SE       SN       TI       TL        Y       ZN
272.97   78.932   66.141   .44721   .00000   985.44   134.49   3.7815   1890.8

DETECTION LIMIT          N=5      ALL2    7-JUN-88 16:22:22
  LV
.89366
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
37.229   173.38   29.047   4462.0   99.400   14.381   2424.1   23.601   39.128   42.251
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
93.356   .44721   90.334   179.53   15.388   2398.1   749.57   59.569   824.03   51.134
   P       PB       SB       SE       SN       TI       TL        Y       ZN
545.95   157.86   132.28   .89443   .00000   1970.9   268.98   7.5631   3781.6

% RELATIVE STANDARD DEVIATION   N=5      ALL2    7-JUN-88 16:22:26
  LV
.00885
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-1.147   .49417   4.5442   .32524   .59115   .44376   .26337   2.6668   .25205   .19207
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.3307   -223.6   .47326   46.948   .08902   .28989   .52760   -.7058   .55635   1.8668
   P       PB       SB       SE       SN       TI       TL        Y       ZN
1.0507   .86544   .52852   -223.6   .00000   .59492   1.1542   -36.36   .54519
SAT>PC
ENTER SAMPLE NAME>09170
ENTER CLASS NAME>1/10
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5      ALL2    7-JUN-88 16:24:54
BLANK SUBTRACTED
  LV
5046.6
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-.6986   83.554   .79677   -1.558   1.3856   .00742   75.769   .03089   .12494   .37755
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-5.860   .00000   20.493   .02158   15.285   19.354   1.7967   -.0922   23.276   .25284
   P       PB       SB       SE       SN       TI       TL        Y       ZN
1.6981   2.0322   .70621   -.4247   4.9980   21.871   .28347   .00061   5.5511

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 16:24:59
BLANK SUBTRACTED
  LV
.22355
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.02130   .16112   .02410   .21363   .00547   .00001   .23815   .00068   .00142   .00367
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.06685   .00000   .11731   .00534   .37739   .02855   .00534   .00628   .07097   .00388
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.01233   .01410   .03023   .00073   11.176   .05051   .01496   .00082   .01221
```

```
DETECTION LIMIT          N=5     ALL2    7-JUN-88 16:25:09
BLANK SUBTRACTED
  LV
.44710
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.04260   .32225   .04820   .42726   .01095   .00003   .47630   .00137   .00285   .00734
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.13370   .00000   .23461   .01067   .75478   .05710   .01068   .01256   .14194   .00777
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.02466   .02819   .06047   .00145   22.352   .10101   .02991   .00165   .02442

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:25:22
BLANK SUBTRACTED
  LV
.00443
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-3.049   .19284   3.0249   -13.71   .39496   .20203   .31431   2.2124   1.1404   .97225
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-[illegible]41   .00000   .57243   24.731   2.4690   .14751   .29732   -6.810   .30492   1.5361
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.72599   .69354   4.2911   -.1709   223.61   .23093   5.2758   135.67   .21998

MEAN    N=5     ALL2    7-JUN-88 16:25:37
  LV
3046.6
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-1597.   15576.   287.90   ******   7591.9   1572.0   ******   441.60   7794.0   10851.
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
******   .00000   9104.5   411.70   8667.3   ******   68819.   -4232.   69163.   1413.5
  P        PB       SB       SE       SN       TI       TL       Y        ZN
26434.   8410.7   12425.   -.1000   .10000   ******   11583.   -7.000   ******

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 16:25:40
  LV
.22360
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
49.288   30.453   9.2561   1728.6   30.084   3.0208   1446.8   10.310   25.353   30.173
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
143.48   .00000   27.534   54.256   26.509   586.92   199.09   46.691   211.38   22.150
  P        PB       SB       SE       SN       TI       TL       Y        ZN
191.55   52.049   86.515   .22361   .22361   381.46   61.318   4.5277   742.21

DETECTION LIMIT          N=5     ALL2    7-JUN-88 16:25:43
  LV
.44710
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
98.576   60.906   18.512   3457.1   60.169   6.0415   2893.5   20.620   50.705   60.346
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
286.96   .00000   55.068   108.51   53.017   1173.8   398.18   93.382   422.76   44.300
  P        PB       SB       SE       SN       TI       TL       Y        ZN
383.10   104.10   173.03   .44721   .44721   762.92   122.64   9.0554   1484.4
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:25:46
  LV
.00442
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-3.087   .19552   3.2150   .25098   .39628   .19216   .31517   2.3347   .32528   .27806
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-1.140   .00000   .30242   13.178   .30585   .14750   .28930   -1.103   .30562   1.5670
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.72462   .61884   .69633   -223.6   223.61   .23296   .52938   -64.65   .21581
[illegible]
ENTER SAMPLE NAME>09171
ENTER CLASS NAME>1/10
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 16:28:25
BLANK SUBTRACTED
  LV
5046.9
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-.4275   50.590   .53402   -.7669   .45601   .00264   117.98   .13016   .04909   .15425
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-3.883   .00000   6.3473   .09763   14.514   6.4246   .74677   -.0585   15.592   .07465
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.90412   2.8006   .83511   -.2761   14.993   13.616   .19902   -.0095   8.7504

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:28:29
BLANK SUBTRACTED
  LV
.22273
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.01789   .48754   .02330   .28472   .00478   .00006   .29085   .00157   .00088   .00169
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.02652   .00000   .07639   .01098   .18424   .08319   .00657   .00711   .14535   .00489
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.01843   .01238   .03846   .00193   33.524   .12804   .01152   .00037   .03252

DETECTION LIMIT         N=5     ALL2    7-JUN-88 16:28:40
BLANK SUBTRACTED
  LV
.44546
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.03578   .97507   .04660   .56943   .00957   .00012   .58171   .00313   .00177   .00338
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.05305   .00000   .15277   .02195   .36849   .16639   .01315   .01422   .29070   .00978
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.03687   .02477   .07692   .00385   67.049   .25608   .02304   .00075   .06503

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:28:52
BLANK SUBTRACTED
  LV
.00441
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-4.185   .96370   4.3633   -37.13   1.0490   2.3329   .24653   1.2038   1.8010   1.0949
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-.6832   .00000   1.2034   11.243   1.2694   1.2949   .88014   -12.15   .93224   6.5474
  P        PB       SB       SE       SN       TI       TL       Y        ZN
2.0389   .44216   4.6052   -.6980   223.61   .94036   5.7881   -3.954   .37159
```

```
MEAN     N=5      ALL2     7-JUN-88 16:29:08
  LV
5046.9
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
-969.5   9434.2   187.00   ******   2505.5   1056.5   ******   1939.1   6401.4   9004.6
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-8340.   .00000   5783.3   1184.9   8613.3   ******   29795.   -3982.   46481.   396.30
  P        PB       SB       SE       SN       TI       TL        Y       ZN
14129.   11078.   12550.   .10000   .30000   ******   10878.   -62.50   ******

STANDARD DEVIATION       N=5      ALL2     7-JUN-88 16:29:10
  LV
.22273
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
41.372   90.935   8.9443   2318.6   26.199   3.1623   1786.6   23.663   15.377   13.696
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
57.224   .00000   17.919   111.61   12.681   1709.7   244.94   52.732   429.34   27.894
  P        PB       SB       SE       SN       TI       TL        Y       ZN
285.48   49.635   113.28   .41833   .67082   958.28   47.246   2.0616   1971.9

DETECTION LIMIT          N=5      ALL2     7-JUN-88 16:29:13
  LV
.44546
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
82.744   181.87   17.889   4637.2   52.398   6.3246   3573.2   47.325   30.753   27.392
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
114.45   .00000   35.837   223.23   25.363   3419.3   489.89   105.46   858.68   55.788
  P        PB       SB       SE       SN       TI       TL        Y       ZN
570.96   99.269   226.55   .83666   1.3416   1916.6   94.493   4.1231   3943.8

% RELATIVE STANDARD DEVIATION   N=5      ALL2     7-JUN-88 16:29:17
  LV
.00441
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
-4.267   .96389   4.7830   .33980   1.0457   .29932   .24996   1.2203   .24021   .15210
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.6861   .00000   .30983   9.4197   .14723   1.2922   .82236   -1.324   .92369   7.0386
  P        PB       SB       SE       SN       TI       TL        Y       ZN
2.0206   .44806   .90263   418.33   223.61   .93945   .43433   -3.298   .36760
SAT>PC
ENTER SAMPLE NAME>09172
ENTER CLASS NAME>1/10
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5      ALL2     7-JUN-88 16:32:00
BLANK SUBTRACTED
  LV
5046.8
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
-.4230   25.970   .43587   -.7674   .45565   .04474   53.427   .22978   .14754   .18798
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-3.708   .00000   5.2402   .33262   14.384   7.3894   .82084   -.0554   14.438   .06546
  P        PB       SB       SE       SN       TI       TL        Y       ZN
.96860   6.0954   .80927   -.1446   .00049   13.373   .30398   .00879   8.7374
```

```
STANDARD DEVIATION       N=5      ALL2    7-JUN-88 16:32:04
BLANK SUBTRACTED
  LV
.57022
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
.01421    .11394    .04489    .42964    .00196    .00021    .50914    .00051    .00083    .00183
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
.02741    .00000    .04544    .01301    .20768    .03006    .00332    .00277    .04792    .00537
   P        PB        SB        SE        SN        TI        TL         Y        ZN
.01006    .01727    .02432    .00079    17.670    .05752    .02032    .00096    .01882

DETECTION LIMIT          N=5      ALL2    7-JUN-88 16:32:15
BLANK SUBTRACTED
  LV
1.1404
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
.02842    .22788    .08977    .85928    .00393    .00042    1.0183    .00102    .00167    .00366
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
.05482    .00000    .09089    .02603    .41537    .06011    .00663    .00554    .09584    .01074
   P        PB        SB        SE        SN        TI        TL         Y        ZN
.02013    .03453    .04865    .00157    35.340    .11503    .04063    .00192    .03764

% RELATIVE STANDARD DEVIATION   N=5      ALL2    7-JUN-88 16:32:27
BLANK SUBTRACTED
  LV
.01130
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
-3.359    .43873    10.298    -55.99    .43112    .46849    .95296    .22152    .56543    .97312
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
-.7391    .00000    .86722    3.9122    1.4439    .40675    .40405    -4.997    .33191    8.2036
   P        PB        SB        SE        SN        TI        TL         Y        ZN
1.0390    .28329    3.0057    -.5444    ******    .43009    6.6833    10.920    .21539

MEAN    N=5     ALL2    7-JUN-88 16:32:43
  LV
5046.8
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
-959.2    4846.6    149.30    ******    2503.5    3165.3    ******    3441.8    8134.7    9283.5
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
-7965.    .00000    5523.2    3573.9    8603.9    ******    32481.    -3959.    43073.    343.80
   P        PB        SB        SE        SN        TI        TL         Y        ZN
15128.    23382.    12302.    .00000    .00000    ******    11141.    38.000    ******

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 16:32:45
  LV
.57022
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
32.838    20.828    17.250    3448.6    10.524    10.474    3059.6    7.6692    15.018    16.051
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
58.553    .00000    10.521    132.01    15.113    604.19    120.09    20.605    137.25    30.636
   P        PB        SB        SE        SN        TI        TL         Y        ZN
156.23    65.550    69.759    .35355    .35355    421.01    82.687    5.2797    1106.3
```

```
DETECTION LIMIT          N=5     ALL2    7-JUN-88 16:32:48
  LV
1.1404
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
65.676   41.656   34.501   6897.2   21.048   20.947   6119.3   15.338   30.036   32.101
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
117.11   .00000   21.043   264.02   30.227   1208.4   240.18   41.209   274.51   61.272
  P        PB       SB       SE       SN       TI       TL       Y        ZN
312.47   131.10   139.52   .70711   .70711   842.03   165.37   10.559   2212.7

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:32:52
  LV
.01130
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-3.423   .42974   11.554   .50541   .42036   .33089   .94510   .22283   .18462   .17289
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-.7351   .00000   .19049   3.6937   .17566   .39718   .36973   -.5204   .31866   8.9110
  P        PB       SB       SE       SN       TI       TL       Y        ZN
1.0327   .28034   .56703   .00000   .00000   .42024   .74217   13.894   .20659
SAT>PC
ENTER SAMPLE NAME>096\6\173
ENTER CLASS NAME>1/10
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5     ALL2    7-JUN-88 16:35:42
BLANK SUBTRACTED
  LV
5046.3
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-.5652   120.37   1.1015   -.9903   1.3555   .00554   75.000   .00027   .06762   .29616
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-4.946   .00000   14.952   -.0070   11.199   20.633   1.6686   -.0902   32.651   .14074
  P        PB       SB       SE       SN       TI       TL       Y        ZN
1.3738   .72977   .51206   -.5434   14.994   17.688   .25100   -.0008   2.1049

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 16:35:46
BLANK SUBTRACTED
  LV
.57043
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.00802   .33224   .01107   .42484   .00334   .00007   .14067   .00117   .00084   .00214
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.04917   .00000   .07247   .01631   .13357   .05924   .00585   .00438   .13441   .00081
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.01502   .00917   .02984   .00151   13.688   .04816   .02144   .00122   .01066

DETECTION LIMIT          N=5     ALL2    7-JUN-88 16:35:56
BLANK SUBTRACTED
  LV
1.1409
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.01605   .66447   .02215   .84969   .00667   .00014   .28133   .00234   .00167   .00428
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.09833   .00000   .14494   .03261   .26713   .11849   .01169   .00876   .26881   .00162
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.03004   .01835   .05968   .00301   27.375   .09633   .04288   .00243   .02133
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:36:09
BLANK SUBTRACTED
  LV
.01130
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
-1.420  .27602  1.0055  -42.90  .24608  1.2475  .18755  434.69  1.2353  .72329
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
-.9940  .00000  .48465  -231.9  1.1927  .28712  .35039  -4.855  .41165  .57455
   P      PB      SB      SE      SN      TI      TL       Y      ZN
1.0934  1.2570  5.8277  -.2774  91.287  .27229  8.5410  -153.4  .50662

MEAN    N=5     ALL2    7-JUN-88 16:36:24
  LV
5046.3
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
-1288.  22434.  404.90  ******  7426.3  1369.7  ******  -20.30  6784.0  10177.
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
******  .00000  7803.1  120.80  8377.8  ******  64114.  -4217.  96835.  773.50
   P      PB      SB      SE      SN      TI      TL       Y      ZN
21406.  3748.7  12089.  .10000  .30000  ******  11599.  -14.70  ******

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:36:27
  LV
.57043
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
18.565  61.673  4.2632  3457.0  18.431  2.4392  883.30  17.616  14.147  16.685
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
106.21  .00000  16.634  165.76  8.8089  1232.7  213.77  32.335  393.51  4.6503
   P      PB      SB      SE      SN      TI      TL       Y      ZN
231.77  36.463  84.871  .65192  .27386  359.16  86.045  6.6951  650.69

DETECTION LIMIT         N=5     ALL2    7-JUN-88 16:36:30
  LV
1.1409
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
37.131  123.35  8.5264  6914.0  36.862  4.8785  1766.6  35.232  28.293  33.369
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
212.42  .00000  33.267  331.52  17.618  2465.5  427.55  64.671  787.01  9.3005
   P      PB      SB      SE      SN      TI      TL       Y      ZN
463.54  72.926  169.74  1.3038  .54772  718.33  172.09  13.390  1301.4

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:36:33
  LV
.01130
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
-1.442  .27491  1.0529  .50536  .24819  .17809  .19440  -86.78  .20853  .16394
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
-.9999  .00000  .21317  137.22  .10515  .29062  .33343  -.7667  .40637  .60120
   P      PB      SB      SE      SN      TI      TL       Y      ZN
1.0827  .97269  .70204  651.92  91.287  .27110  .74187  -45.55  .47715
SAT>PC
ENTER SAMPLE NAME>09174
ENTER CLASS NAME>STRT
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>
```

```
MEAN     N=5     ALL2    7-JUN-88 16:40:20
BLANK SUBTRACTED
  LV
5046.8
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-.0057   .05204   .06694   19.334   .06343   .00007   128.67   .00098   -.0002   -.0045
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.0641   .00000   .99110   -.0112   .26922   12.085   .05852   .04715   .31594   .00703
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.05129   -.0015   -.0351   -.0747   .00000   .25399   -.0353   -.0267   .03674

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 16:40:24
BLANK SUBTRACTED
  LV
.44738
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.01980   .02870   .03383   3.9565   .00040   .00003   3.1709   .00172   .00085   .00204
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.00640   .00000   .03883   .01041   .24909   .04141   .00023   .00073   .01784   .00282
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.00682   .01266   .02423   .00154   .00000   .00138   .00599   .00104   .00076

DETECTION LIMIT          N=5      ALL2    7-JUN-88 16:40:34
BLANK SUBTRACTED
  LV
.89475
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.03959   .05739   .06766   7.9130   .00080   .00006   6.3418   .00344   .00170   .00408
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.01280   .00000   .07766   .02083   .49817   .08283   .00046   .00146   .03569   .00563
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.01364   .02531   .04846   .00309   .00000   .00275   .01199   .00208   .00152

% RELATIVE STANDARD DEVIATION   N=5      ALL2    7-JUN-88 16:40:47
BLANK SUBTRACTED
  LV
.00886
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-349.4   55.143   50.536   20.464   .63025   42.639   2.4644   174.47   -497.2   -45.10
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-9.982   .00000   3.9177   -92.79   92.520   .34269   .39084   1.5517   5.6480   40.074
   P       PB       SB       SE       SN       TI       TL        Y       ZN
13.293   -842.5   -69.09   -2.067   .00000   .54158   -17.00   -3.893   2.0749

MEAN     N=5     ALL2    7-JUN-88 16:41:02
  LV
5046.8
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
6.2000   17.300   7.6000   ******   357.40   823.40   ******   -9.500   5488.7   7690.9
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-142.1   .00000   4525.4   78.200   7605.6   ******   4156.2   -3198.   1381.7   10.200
   P       PB       SB       SE       SN       TI       TL        Y       ZN
909.00   78.800   9717.3   -.7000   .00000   1938.6   9558.3   -157.0   11125.
```

```
STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:41:05
  LV
.44738
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
45.787  5.3456  12.992  32104.  2.1622  1.6355  19261.  25.921  14.923  16.207
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
13.754  .00000  8.8136  105.89  17.217  839.94  8.3334  5.6192  52.619  16.076
   P      PB      SB      SE      SN      TI      TL       Y      ZN
105.67  48.092  69.230  .27386  .00000  10.157  24.499  5.7228  45.539

DETECTION LIMIT         N=5     ALL2    7-JUN-88 16:41:08
  LV
.89475
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
91.574  10.691  25.985  64207.  4.3243  3.2710  38523.  51.841  29.846  32.414
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
27.508  .00000  17.627  211.78  34.434  1679.9  16.667  11.238  105.24  32.153
   P      PB      SB      SE      SN      TI      TL       Y      ZN
211.33  96.184  138.46  .54772  .00000  20.315  48.998  11.446  91.079

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:41:11
  LV
.00886
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
738.50  30.899  170.95  6.1824  .60497  .19863  2.4711  -272.8  .27189  .21073
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
-9.679  .00000  .19476  135.41  .22637  .33788  .20051  -.1757  3.8083  157.61
   P      PB      SB      SE      SN      TI      TL       Y      ZN
11.624  61.030  .71244  -39.12  .00000  .52396  .25631  -3.645  .40935
SAT>PC
ENTER SAMPLE NAME>09175
ENTER CLASS NAME>STRTR
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 16:43:45
BLANK SUBTRACTED
  LV
5046.3
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
-.0124  .23454  .06981  23.269  .06783  .00010  130.25  .00224  -.0007  -.0043
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
-.0668  .00000  1.1621  -.0080  -.0694  13.825  .06433  .04544  .24772  .00626
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.04394  -.0065  .02338  -.0765  4.9980  .26501  -.0158  -.0320  .03727

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:43:50
BLANK SUBTRACTED
  LV
.27413
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.01706  .09603  .02133  .42938  .00049  .00005  1.2812  .00039  .00089  .00151
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.00594  .00000  .04315  .00188  .28772  .28231  .00091  .00548  .02278  .00184
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.01501  .02081  .03210  .00102  11.176  .00187  .02221  .00342  .00034
```

```
DETECTION LIMIT           N=5      ALL2    7-JUN-88 16:44:00
BLANK SUBTRACTED
  LV
.54826
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
.03412    .19206    .04265    .85875    .00098    .00011    2.5624    .00078    .00178    .00303
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
.01187    .00000    .08629    .00376    .57544    .56463    .00182    .01095    .04556    .00368
  P         PB        SB        SE        SN        TI        TL        Y         ZN
.03002    .04162    .06419    .00205    22.352    .00373    .04442    .00684    .00068

% RELATIVE STANDARD DEVIATION   N=5      ALL2    7-JUN-88 16:44:13
BLANK SUBTRACTED
  LV
.00543
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
-137.9    40.944    30.549    1.8453    .72299    56.912    .98364    17.412    -119.2    -35.03
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
-8.888    .00000    3.7129    -23.50    -414.6    2.0421    1.4135    12.055    9.1957    29.442
  P         PB        SB        SE        SN        TI        TL        Y         ZN
34.159    -321.3    137.29    -1.339    223.61    .70412    -140.1    -10.70    .91684

MEAN     N=5      ALL2    7-JUN-88 16:44:28
  LV
5046.3
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
-9.300    51.300    8.7000    ******    381.40    827.70    ******    9.5000    5478.4    7691.8
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
-147.8    .00000    4565.1    110.90    7580.9    ******    4372.2    -3210.    1180.2    5.8000
  P         PB        SB        SE        SN        TI        TL        Y         ZN
795.00    61.300    9885.7    -.1000    .10000    2020.9    9640.1    -186.2    11158.

STANDARD DEVIATION        N=5      ALL2    7-JUN-88 16:44:31
  LV
.27413
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
39.460    17.891    8.1899    3499.3    2.6786    2.5150    7786.6    5.8949    15.920    12.652
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
12.741    .00000    10.108    19.129    20.734    5797.1    33.857    40.541    67.267    10.515
  P         PB        SB        SE        SN        TI        TL        Y         ZN
232.63    78.626    92.058    .41833    .22361    13.903    90.395    18.824    20.305

DETECTION LIMIT           N=5      ALL2    7-JUN-88 16:44:34
  LV
.54826
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
78.920    35.781    16.380    6998.6    5.3572    5.0299    15573.    11.790    31.839    25.303
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
25.481    .00000    20.216    38.258    41.469    11594.    67.715    81.082    134.53    21.031
  P         PB        SB        SE        SN        TI        TL        Y         ZN
465.26    157.25    184.12    .83666    .44721    27.806    180.79    37.647    40.610
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:44:37
  LV
.00543
  AG     AL     AS     B      BA     BE     CA     CD     CO     CR
-424.3 34.875 94.137 .71810 .70231 .30385 .98690 62.052 .29059 .16448
  CU     FE     FE     HG     K      MG     MN     MO     NA     NI
-8.620 .00000 .22142 17.249 .27351 2.0391 .77438 -1.263 5.6996 181.30
  P      PB     SB     SE     SN     TI     TL     Y      ZN
29.262 128.26 .93122 -418.3 223.61 .68796 .93770 -10.11 .18198
SAT>PC
ENTER SAMPLE NAME>09176
ENTER CLASS NAME>STRT
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 16:47:08
BLANK SUBTRACTED
  LV
5046.8
  AG     AL     AS     B      BA     BE     CA     CD     CO     CR
.01638 .02681 .17186 20.204 .06886 .02390 126.43 .09286 .09765 .06178
  CU     FE     FE     HG     K      MG     MN     MO     NA     NI
.02940 .00000 1.0401 .22348 .12501 13.441 .05686 .03826 .29097 .00491
  P      PB     SB     SE     SN     TI     TL     Y      ZN
.08499 .17161 .04064 -.0734 .00000 .24444 .09769 -.0196 .17148

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:47:12
BLANK SUBTRACTED
  LV
.44697
  AG     AL     AS     B      BA     BE     CA     CD     CO     CR
.01707 .02167 .02031 4.2071 .00058 .00023 .14082 .00125 .00166 .00387
  CU     FE     FE     HG     K      MG     MN     MO     NA     NI
.00441 .00000 .10995 .00771 .30368 .06225 .00044 .00180 .02219 .00180
  P      PB     SB     SE     SN     TI     TL     Y      ZN
.01689 .01433 .04680 .00053 .00000 .00139 .00958 .00153 .00164

DETECTION LIMIT         N=5     ALL2    7-JUN-88 16:47:23
BLANK SUBTRACTED
  LV
.89394
  AG     AL     AS     B      BA     BE     CA     CD     CO     CR
.03414 .04333 .04063 8.4142 .00117 .00047 .28163 .00251 .00332 .00773
  CU     FE     FE     HG     K      MG     MN     MO     NA     NI
.00883 .00000 .21991 .01542 .60735 .12450 .00088 .00359 .04439 .00361
  P      PB     SB     SE     SN     TI     TL     Y      ZN
.03377 .02865 .09360 .00105 .00000 .00278 .01917 .00306 .00327

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:47:35
BLANK SUBTRACTED
  LV
.00886
  AG     AL     AS     B      BA     BE     CA     CD     CO     CR
104.18 80.808 11.820 20.824 .84849 .97691 .11138 1.3498 1.6988 6.2586
  CU     FE     FE     HG     K      MG     MN     MO     NA     NI
15.015 .00000 10.572 3.4493 242.93 .46316 .77236 4.6981 7.6277 36.735
  P      PB     SB     SE     SN     TI     TL     Y      ZN
19.870 8.3476 115.16 -.7159 .00000 .56815 9.8101 -7.818 .95439
```

```
MEAN      N=5       ALL2     7-JUN-88 16:47:50
  LV
5046.8
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
57.200    12.600    47.900    ******    387.10    2029.5    ******    1376.4    7226.3    8239.4
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
58.700    .00000    4536.9    2464.3    7595.4    ******    4095.0    -3264.    1308.0    -1.900
  P         PB        SB        SE        SN        TI        TL        Y         ZN
1431.3    734.80    9933.8    -.4000    .00000    1867.1    10103.    -118.0    19244.

STANDARD DEVIATION        N=5       ALL2     7-JUN-88 16:47:53
  LV
.44697
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
39.479    4.0373    7.8054    34151.    3.1898    11.853    878.24    18.866    29.461    31.781
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
9.4776    .00000    25.876    78.246    21.390    1259.7    16.275    13.387    65.583    10.292
  P         PB        SB        SE        SN        TI        TL        Y         ZN
261.73    54.400    134.28    .22361    .00000    10.371    40.053    8.4187    99.565

DETECTION LIMIT           N=5       ALL2     7-JUN-88 16:47:56
  LV
.89394
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
78.958    8.0747    15.611    68303.    6.3796    23.707    1756.5    37.732    58.922    63.563
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
18.955    .00000    51.751    156.49    42.780    2519.3    32.550    26.773    131.17    20.584
  P         PB        SB        SE        SN        TI        TL        Y         ZN
523.46    108.80    268.55    .44721    .00000    20.741    80.106    16.837    199.13

% RELATIVE STANDARD DEVIATION    N=5       ALL2     7-JUN-88 16:47:59
  LV
.00886
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
69.019    32.042    16.295    6.6674    .82403    .58405    .11467    1.3707    .40769    .38572
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
16.146    .00000    .57034    3.1752    .28162    .45566    .39744    -.4102    5.0140    -541.7
  P         PB        SB        SE        SN        TI        TL        Y         ZN
18.286    7.4033    1.3517    -55.90    .00000    .55544    .39646    -7.135    .51738
SAT>PC
ENTER SAMPLE NAME>09177
ENTER CLASS NAME>1/10
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN      N=5       ALL2     7-JUN-88 16:50:30
BLANK SUBTRACTED
  LV
5047.4
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
-.7061    94.074    .89115    -1.465    1.4037    .00819    79.909    .03581    .16920    .44497
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
-5.976    .00000    23.676    .00132    14.891    20.728    1.9265    -.1028    25.694    .32059
  P         PB        SB        SE        SN        TI        TL        Y         ZN
1.6849    2.1261    .84356    -.4772    4.9975    21.503    .33324    -.0012    5.8442
```

```
STANDARD DEVIATION       N=5     ALL2    7-JUN-88 16:50:35
BLANK SUBTRACTED
  LV
.54737
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.01557   .31078   .03152   .28725   .00520   .00009   2.0038   .00061   .00173   .00112
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.04360   .00000   .09518   .00963   .30429   .09490   .00617   .00389   .06923   .00445
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.03715   .01591   .03116   .00215   11.175   .05161   .01610   .00142   .01628

DETECTION LIMIT          N=5     ALL2    7-JUN-88 16:50:45
BLANK SUBTRACTED
  LV
1.0947
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.03114   .62157   .06304   .57451   .01041   .00018   4.0077   .00121   .00346   .00224
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.08720   .00000   .19036   .01926   .60859   .18980   .01234   .00778   .13846   .00890
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.07431   .03181   .06233   .00429   22.350   .10321   .03219   .00284   .03256

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:50:58
BLANK SUBTRACTED
  LV
.01084
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-2.205   .33036   3.5373   -19.61   .37077   1.1073   2.5077   1.6903   1.0214   .25178
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.7295   .00000   .40201   732.06   2.0435   .45782   .32033   -3.783   .26944   1.3884
   P       PB       SB       SE       SN       TI       TL        Y       ZN
2.2051   .74815   3.6943   -.4496   223.61   .24000   4.8302   -119.2   .27854

MEAN    N=5     ALL2    7-JUN-88 16:51:13
  LV
5047.4
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-1614.   17538.   324.20   ******   7692.1   1672.4   ******   515.90   8593.5   11411.
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
******   .00000   9853.5   205.70   8640.8   ******   73674.   -4311.   76314.   1800.6
   P       PB       SB       SE       SN       TI       TL        Y       ZN
26235.   8846.7   12897.   .00000   .10000   ******   11889.   -16.90   ******

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 16:51:15
  LV
.54737
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
36.089   58.543   12.107   2285.4   28.573   5.6833   12155.   9.1269   30.919   9.5184
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
94.568   .00000   22.578   97.910   21.273   1972.6   229.98   29.267   204.26   25.498
   P       PB       SB       SE       SN       TI       TL        Y       ZN
577.10   59.982   90.101   .61237   .22361   384.30   66.649   7.8214   987.35
```

```
DETECTION LIMIT          N=5     ALL2    7-JUN-88 16:51:19
  LV
1.0947
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
72.179   117.09   24.214   4570.8   57.146   11.367   24309.   18.254   61.839   19.037
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
189.14   .00000   45.155   195.82   42.546   3945.1   459.96   58.535   408.52   50.997
  P        PB       SB       SE       SN       TI       TL       Y        ZN
1154.2   119.96   180.20   1.2247   .44721   768.59   133.30   15.643   1974.7

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:51:22
  LV
.01084
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-2.236   .33380   3.7344   .33214   .37146   .33983   2.5103   1.7691   .35980   .08341
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-.7367   .00000   .22913   47.598   .24619   .46282   .31216   -.6789   .26766   1.4161
  P        PB       SB       SE       SN       TI       TL       Y        ZN
2.1997   .67801   .69859   .00000   223.61   .23857   .56057   -46.28   .27297
SAT>PC
ENTER SAMPLE NAME>5PPM
ENTER CLASS NAME>MRI5
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 16:53:58
BLANK SUBTRACTED
  LV
5047.4
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
4.9279   -.0338   .02476   4.4413   .00141   3.9397   4.7566   4.9558   5.0172   4.9838
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
4.8902   -.0000   6.0089   -.0014   1.5740   .00083   .00138   -.0726   .02858   .00888
  P        PB       SB       SE       SN       TI       TL       Y        ZN
1.7476   5.2699   .39710   -.0229   -.0005   .00335   5.3173   4.9053   7.8809

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 16:54:02
BLANK SUBTRACTED
  LV
.41845
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.04193   .02426   .02812   2.1432   .00079   .03333   .04655   .04694   .04314   .05341
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.04981   .00001   .12305   .00200   .32386   .00038   .00016   .00565   .01862   .00307
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.03052   .06424   .05235   .00068   17.668   .00124   .06053   .04779   .06897

DETECTION LIMIT          N=5     ALL2    7-JUN-88 16:54:12
BLANK SUBTRACTED
  LV
.83689
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.08386   .04853   .05624   4.2864   .00159   .06667   .09310   .09389   .08629   .10682
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.09963   .00001   .24609   .00400   .64772   .00076   .00031   .01129   .03725   .00614
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.06103   .12848   .10470   .00136   35.336   .00247   .12105   .09558   .13794
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:54:25
BLANK SUBTRACTED
  LV
.00829
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.85089  -71.72  113.56  48.256  56.463  .84608  .97863  .94725  .85991  1.0716
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
1.0187  -223.6  2.0477  -144.9  20.576  45.669  11.315  -7.775  65.160  34.554
   P      PB      SB      SE      SN      TI      TL       Y      ZN
1.7462  1.2190  13.183  -2.971  ******  36.962  1.1383  .97427  .87518

MEAN    N=5     ALL2    7-JUN-88 16:54:41
  LV
5047.4
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
11419.  1.3000  -8.600  ******  18.000  ******  28945.  74743.  94633.  48966.
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
10495.  -.1000  5704.4  178.30  7698.8  329.70  2057.9  -4087.  533.40  20.800
   P      PB      SB      SE      SN      TI      TL       Y      ZN
27207.  20062.  10949.  .00000  .00000  61.600  31514.  26974.  ******

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:54:43
  LV
.41845
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
97.898  4.5222  10.802  17431.  4.3445  1703.1  284.03  714.02  773.66  445.69
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
107.78  .22361  29.267  20.340  22.843  7.8231  6.2890  42.212  55.002  17.527
   P      PB      SB      SE      SN      TI      TL       Y      ZN
474.97  245.24  150.76  .35355  .35355  9.2696  251.24  264.91  4193.9

DETECTION LIMIT         N=5     ALL2    7-JUN-88 16:54:46
  LV
.83689
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
195.80  9.0443  21.603  34863.  8.6891  3406.3  568.06  1428.0  1547.3  891.38
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
215.56  .44721  58.534  40.679  45.686  15.646  12.578  84.423  110.00  35.054
   P      PB      SB      SE      SN      TI      TL       Y      ZN
949.95  490.49  301.52  .70711  .70711  18.539  502.48  529.82  8387.8

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:54:50
  LV
.00829
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.85733  347.86  -125.6  2.7230  24.136  .85048  .98128  .95530  .81754  .91020
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
1.0270  -223.6  .51306  11.408  .29671  2.3728  .30560  -1.033  10.312  84.265
   P      PB      SB      SE      SN      TI      TL       Y      ZN
1.7458  1.2225  1.3769  .00000  .00000  15.048  .79722  .98209  .86674
SAT>PC
ENTER SAMPLE NAME>75PPM
ENTER CLASS NAME>MRI7
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>
```

```
MEAN    N=5     ALL2    7-JUN-88 16:57:16
BLANK SUBTRACTED
  LV
5046.8
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.01911  73.578  .70613  9.5549  .00194  .02322  71.683  -.0078  .00280  .02349
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.01673  .00000  75.303  .00221  75.520  .00318  -.0031  -.1673  73.173  .00200
   P      PB      SB      SE      SN      TI      TL       Y      ZN
25.861  .01585  .22876  -.5713  -4.999  .00211  .06355  -.0162  .01666

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 16:57:21
BLANK SUBTRACTED
  LV
.67038
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.01170  .45299  .01970  2.1477  .00075  .00023  .24392  .00127  .00151  .00509
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.00906  .00000  .26810  .01360  .31873  .00085  .00028  .00427  .50650  .00306
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.12711  .01566  .03662  .00254  20.906  .00135  .01751  .00136  .00064

DETECTION LIMIT         N=5     ALL2    7-JUN-88 16:57:31
BLANK SUBTRACTED
  LV
1.3408
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.02340  .90598  .03941  4.2953  .00151  .00045  .48785  .00255  .00302  .01018
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.01811  .00000  .53620  .02720  .63745  .00170  .00056  .00854  1.0130  .00611
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.25423  .03132  .07325  .00509  41.813  .00269  .03501  .00273  .00129

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 16:57:44
BLANK SUBTRACTED
  LV
.01328
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
61.237  .61566  2.7904  22.477  38.988  .97454  .34028  -16.38  53.932  21.676
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
54.120  .00000  .35603  614.50  .42204  26.650  -8.942  -2.551  .69220  152.75
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.49154  98.794  16.010  -.4450  -418.2  63.907  27.544  -8.422  3.8659

MEAN    N=5     ALL2    7-JUN-88 16:57:59
  LV
5046.8
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
63.500  13717.  253.10  ******  20.900  3430.6  ******  -141.6  5728.4  7922.6
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
31.500  .00000  21976.  214.80  12928.  378.00  2298.5  -4790.  ******  -18.50
   P      PB      SB      SE      SN      TI      TL       Y      ZN
******  693.60  11146.  .10000  -.1000  52.300  11289.  -99.40  10942.
```

```
STANDARD DEVIATION       N=5      ALL2    7-JUN-88 16:58:02
  LV
.67038
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
27.058  85.745  7.5614  17487.  4.1292  15.642  1525.7  19.214  25.898  41.419
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
19.439  .00000  64.048  138.23  22.820  17.418  8.8671  32.065  1517.7  17.446
   P       PB       SB       SE       SN       TI       TL        Y       ZN
1998.8  56.788  108.41  .41833  .41833  10.078  72.363  7.5117  34.624

DETECTION LIMIT          N=5      ALL2    7-JUN-88 16:58:05
  LV
1.3408
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
54.116  171.49  15.123  34975.  8.2583  31.284  3051.4  38.428  51.796  82.838
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
38.878  .00000  128.10  276.46  45.640  34.835  17.734  64.130  3035.4  34.893
   P       PB       SB       SE       SN       TI       TL        Y       ZN
3997.7  113.58  216.82  .83666  .83666  20.157  144.73  15.023  69.249

% RELATIVE STANDARD DEVIATION   N=5      ALL2    7-JUN-88 16:58:08
  LV
.01328
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
42.611  .62509  2.9875  2.9214  19.757  .45595  .35128  -13.57  .45210  .52280
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
61.711  .00000  .29145  64.353  .17652  4.6078  .38578  -.6694  .70108  -94.30
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.49849  8.1875  .97265  418.33  -418.3  19.270  .64102  -7.557  .31644
SAT>PC
ENTER SAMPLE NAME>CAL
ENTER CLASS NAME>BLANK
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5      ALL2    7-JUN-88 17:02:02
BLANK SUBTRACTED
  LV
5046.9
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-.0038  .01071  .00862  -.3382  .00002  .00017  .00659  .00082  .00673  -.0017
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.0044  .00000  -.0343  -.0041  .30384  .00011  -.0001  -.0746  .00499  .00233
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-.0186  .00301  .40666  .00013  .00000  .00033  .10296  .00046  .01276

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 17:02:06
BLANK SUBTRACTED
  LV
.41830
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.00826  .02555  .01044  1.1137  .00042  .00012  .00286  .00068  .00126  .00546
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.00144  .00000  .12535  .00196  .65180  .00019  .00018  .01056  .01600  .00287
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.01253  .01202  .03532  .00056  .00000  .00072  .02330  .00049  .00059
```

```
DETECTION LIMIT         N=5     ALL2    7-JUN-88 17:02:16
BLANK SUBTRACTED
  LV
.83660
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.01652  .05111  .02088  2.2274  .00083  .00024  .00572  .00135  .00252  .01091
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.00288  .00000  .25070  .00393  1.3036  .00038  .00037  .02112  .03200  .00574
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.02507  .02404  .07065  .00112  .00000  .00143  .04659  .00098  .00117

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:02:29
BLANK SUBTRACTED
  LV
.00829
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
-219.5  238.60  121.12  -329.3  2418.7  71.210  43.356  82.639  18.705  -314.4
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
-32.62  .00000  -365.6  -47.78  214.52  177.76  -214.8  -14.16  320.58  122.95
   P      PB      SB      SE      SN      TI      TL       Y      ZN
-67.39  399.29  8.6861  447.89  .00000  216.36  22.626  106.63  4.6025

MEAN    N=5     ALL2    7-JUN-88 17:02:45
  LV
5046.9
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
10.600  9.6000  -14.80  ******  10.400  808.50  170.70  -12.00  5609.3  7714.1
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
-13.90  .00000  4284.7  150.50  7608.2  314.80  1979.7  -4102.  463.70  -16.60
   P      PB      SB      SE      SN      TI      TL       Y      ZN
-174.4  95.600  10958.  .10000  .00000  39.000  10096.  -7.800  9669.8

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 17:02:47
  LV
.41830
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
19.110  4.7618  4.0094  9041.8  2.2749  8.3217  17.301  10.210  22.780  45.247
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
3.0903  .00000  29.505  19.978  46.115  3.9465  7.3705  78.598  47.220  16.376
   P      PB      SB      SE      SN      TI      TL       Y      ZN
194.31  45.686  100.85  .41833  .00000  5.3619  93.730  2.7065  36.696

DETECTION LIMIT         N=5     ALL2    7-JUN-88 17:02:50
  LV
.83660
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
38.219  9.5237  8.0187  18084.  4.5497  16.643  34.602  20.421  45.561  90.495
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
6.1806  .00000  59.011  39.956  92.230  7.8930  14.741  157.20  94.439  32.752
   P      PB      SB      SE      SN      TI      TL       Y      ZN
388.61  91.371  201.70  .83666  .00000  10.724  187.46  5.4129  73.391
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:02:54
  LV
.00829
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
180.28   49.602   -27.09   1.3319   21.874   1.0293   10.135   -85.09   .40612   .58655
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-22.23   .00000   .68862   13.275   .60612   1.2537   .37231   -1.916   10.183   -98.65
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-111.4   47.788   .92033   418.33   .00000   13.748   .92842   -34.70   .37949
SAT>PC
ENTER SAMPLE NAME>09178
ENTER CLASS NAME>1/10
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 17:12:11
BLANK SUBTRACTED
  LV
5047.1
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
-.3323   34.940   .39914   -1.250   .27173   .00221   118.05   .08076   .04697   .16045
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-3.023   .00000   6.2288   .03702   8.5913   11.786   .73750   -.0868   12.166   .07136
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.79683   1.2956   .89877   -.2171   4.9970   10.298   .19816   -.0117   6.6583

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 17:12:15
BLANK SUBTRACTED
  LV
.54759
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
.01387   .29758   .04099   .16725   .00214   .00003   .29199   .00170   .00080   .00059
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.01610   .00000   .05624   .00633   .25095   .10837   .00545   .00678   .09270   .00116
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.02712   .01566   .03435   .00110   20.904   .10715   .01694   .00095   .05292

DETECTION LIMIT         N=5     ALL2    7-JUN-88 17:12:26
BLANK SUBTRACTED
  LV
1.0952
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
.02774   .59516   .08198   .33450   .00427   .00005   .58397   .00340   .00160   .00118
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.03220   .00000   .11249   .01265   .50190   .21675   .01090   .01356   .18539   .00232
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.05424   .03133   .06869   .00220   41.808   .21430   .03389   .00189   .10584

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:12:38
BLANK SUBTRACTED
  LV
.01085
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
-4.174   .85169   10.270   -13.38   .78636   1.2036   .24733   2.1037   1.7034   .36635
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.5326   .00000   .90297   17.089   2.9210   .91949   .73873   -7.809   .76194   1.6233
   P       PB       SB       SE       SN       TI       TL        Y       ZN
3.4034   1.2089   3.8214   -.5071   418.33   1.0405   8.5509   -8.109   .79479
```

```
MEAN      N=5       ALL2      7-JUN-88 17:12:54
  LV
5047.1
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
-749.4    6518.4    135.20    ******    1497.2    1032.6    ******    1194.0    6355.4    9056.3
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
-6494.    .00000    5755.7    568.70    8194.7    ******    29414.    -4193.    36369.    377.50
  P         PB        SB        SE        SN        TI        TL        Y         ZN
12466.    5256.4    12631.    .00000    .10000    77158.    10782.    -74.60    ******

STANDARD DEVIATION        N=5       ALL2      7-JUN-88 17:12:56
  LV
.54759
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
32.149    56.052    15.750    1370.1    11.835    2.2747    1693.3    25.656    14.613    4.9574
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
34.614    .00000    13.595    64.320    17.587    2247.6    205.11    50.565    276.87    6.6238
  P         PB        SB        SE        SN        TI        TL        Y         ZN
420.70    60.168    100.59    .70711    .41833    808.94    69.645    5.2130    3227.4

DETECTION LIMIT           N=5       ALL2      7-JUN-88 17:12:59
  LV
1.0952
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
64.298    112.10    31.501    2740.2    23.670    4.5493    3386.7    51.313    29.226    9.9147
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
69.229    .00000    27.189    128.64    35.175    4495.2    410.22    101.13    553.74    13.248
  P         PB        SB        SE        SN        TI        TL        Y         ZN
841.39    120.34    201.18    1.4142    .83666    1617.9    139.29    10.426    6454.7

% RELATIVE STANDARD DEVIATION   N=5       ALL2      7-JUN-88 17:13:03
  LV
.01085
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
-4.290    .85991    11.650    .19964    .79049    .22029    .23676    2.1488    .22993    .05474
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
-.5330    .00000    .23619    11.310    .21462    .92698    .69733    -1.206    .76128    1.7547
  P         PB        SB        SE        SN        TI        TL        Y         ZN
3.3747    1.1447    .79637    .00000    418.33    1.0484    .64597    -6.988    .78655
SAT>PC
ENTER SAMPLE NAME>09179
ENTER CLASS NAME>1/10
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN      N=5       ALL2      7-JUN-88 17:15:28
BLANK SUBTRACTED
  LV
5048.3
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
-.4729    86.025    .82384    -.9255    .66797    .00702    54.319    .00274    .06168    .31367
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
-3.437    .00000    19.640    .00024    13.515    19.273    .89017    -.1330    17.403    .10756
  P         PB        SB        SE        SN        TI        TL        Y         ZN
1.0953    .58714    .68205    -.4193    4.9965    14.260    .27625    -.0030    2.0369
```

```
STANDARD DEVIATION   N=5    ALL2   7-JUN-88 17:15:33
BLANK SUBTRACTED
  LV
.27346
  AG     AL     AS      B     BA     BE     CA     CD     CO     CR
.00929 .73890 .06984 .28357 .00680 .00010 .88616 .00158 .00132 .00389
  CU     FE     FE     HG      K     MG     MN     MO     NA     NI
.03022 .00000 .13942 .01429 .31046 .05741 .00710 .00476 .14268 .00114
   P     PB     SB     SE     SN     TI     TL      Y     ZN
.02931 .01187 .01839 .00363 20.901 .11527 .02933 .00061 .01569

DETECTION LIMIT      N=5    ALL2   7-JUN-88 17:15:43
BLANK SUBTRACTED
  LV
.54692
  AG     AL     AS      B     BA     BE     CA     CD     CO     CR
.01857 1.4778 .13968 .56714 .01359 .00019 1.7723 .00316 .00264 .00777
  CU     FE     FE     HG      K     MG     MN     MO     NA     NI
.06044 .00000 .27885 .02858 .62092 .11483 .01420 .00952 .28536 .00228
   P     PB     SB     SE     SN     TI     TL      Y     ZN
.05861 .02374 .03677 .00726 41.801 .23054 .05867 .00121 .03138

% RELATIVE STANDARD DEVIATION   N=5    ALL2   7-JUN-88 17:15:56
BLANK SUBTRACTED
  LV
.00542
  AG     AL     AS      B     BA     BE     CA     CD     CO     CR
-1.964 .85894 8.4776 -30.64 1.0175 1.3817 1.6314 57.704 2.1361 1.2389
  CU     FE     FE     HG      K     MG     MN     MO     NA     NI
-.8792 .00000 .70988 5952.2 2.2972 .29790 .79748 -3.579 .81987 1.0605
   P     PB     SB     SE     SN     TI     TL      Y     ZN
2.6755 2.0213 2.6958 -.8652 418.30 .80833 10.619 -20.02 .77018

MEAN   N=5    ALL2   7-JUN-88 17:16:11
  LV
5048.3
  AG     AL     AS      B     BA     BE     CA     CD     CO     CR
-1075. 16041. 298.40 ****** 3666.3 1535.5 ****** 17.000 6672.2 10326.
  CU     FE     FE     HG      K     MG     MN     MO     NA     NI
-7385. .00000 8907.4 194.80 8545.0 ****** 35229. -4537. 51843. 584.30
   P     PB     SB     SE     SN     TI     TL      Y     ZN
17098. 2952.9 12369. -.1000 .10000 ****** 11559. -27.00 ******

STANDARD DEVIATION   N=5    ALL2   7-JUN-88 17:16:14
  LV
.27346
  AG     AL     AS      B     BA     BE     CA     CD     CO     CR
21.467 138.19 26.827 2265.9 37.278 6.0103 5377.2 23.867 23.573 32.341
  CU     FE     FE     HG      K     MG     MN     MO     NA     NI
64.911 .00000 33.044 145.30 21.903 1185.9 265.92 35.368 422.96 6.5250
   P     PB     SB     SE     SN     TI     TL      Y     ZN
454.57 46.276 58.195 .22361 .41833 865.97 121.10 3.3354 953.71

DETECTION LIMIT      N=5    ALL2   7-JUN-88 17:16:17
  LV
.54692
  AG     AL     AS      B     BA     BE     CA     CD     CO     CR
42.934 276.37 53.654 4531.7 74.557 12.021 10754. 47.734 47.146 64.681
  CU     FE     FE     HG      K     MG     MN     MO     NA     NI
129.82 .00000 66.088 290.61 43.806 2371.8 531.83 70.737 845.93 13.050
   P     PB     SB     SE     SN     TI     TL      Y     ZN
909.14 92.551 116.39 .44721 .83666 1731.9 242.20 6.6708 1907.4
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:16:20
  LV
.00542
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-1.997   .86144   8.9902   .33136   1.0168   .39143   1.6332   140.39   .35331   .31318
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-.8790   .00000   .37097   74.591   .25633   .29919   .75482   -.7796   .81586   1.1167
  P        PB       SB       SE       SN       TI       TL       Y        ZN
2.6587   1.5671   .47048   -223.6   418.33   .81039   1.0477   -12.35   .72128
SAT>PC
ENTER SAMPLE NAME>09180
ENTER CLASS NAME>STRT
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 17:18:52
BLANK SUBTRACTED
  LV
5047.9
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-.0066   .02895   .04950   21.105   .05162   .00025   123.85   .00149   .00569   .00186
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-.0475   .00000   .84895   -.0133   1.1066   7.2221   .04137   .02372   .26585   .00491
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.02720   -.0026   .07104   -.0713   .00099   .18135   -.0066   -.0157   .03863

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 17:18:57
BLANK SUBTRACTED
  LV
.54737
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.00822   .02496   .02294   3.1265   .00042   .00004   .08779   .00116   .00087   .00420
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.00273   .00000   .07843   .01147   .37763   .02513   .00016   .00297   .02243   .00229
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.01868   .01208   .02831   .00056   17.665   .00052   .01920   .00063   .00046

DETECTION LIMIT          N=5     ALL2    7-JUN-88 17:19:07
BLANK SUBTRACTED
  LV
1.0947
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.01643   .04991   .04588   6.2529   .00083   .00007   .17559   .00232   .00174   .00839
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.00546   .00000   .15686   .02294   .75525   .05025   .00032   .00594   .04487   .00458
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.03736   .02417   .05663   .00112   35.331   .00104   .03840   .00127   .00093

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:19:19
BLANK SUBTRACTED
  LV
.01084
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-125.0   86.221   46.352   14.814   .80643   14.871   .07089   77.943   15.333   225.27
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-5.747   .00000   9.2385   -86.05   34.124   .34791   .39089   12.523   8.4384   46.653
  P        PB       SB       SE       SN       TI       TL       Y        ZN
68.666   -460.9   39.859   -.7877   ******   .28752   -290.5   -4.037   1.2020
```

```
MEAN     N=5      ALL2    7-JUN-88 17:19:35
  LV
5047.9
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
4.1000   13.000   .90000   ******   292.80   829.60   ******   -1.900   5593.7   7745.4
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-106.4   .00000   4493.0   56.800   7666.5   ******   3520.6   -3373.   1234.1   -1.900
  P        PB       SB       SE       SN       TI       TL       Y        ZN
535.70   74.400   10022.   -.3000   .00000   1394.9   9675.2   -96.60   11240.

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 17:19:37
  LV
.54737
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
19.008   4.6503   8.8133   25339.   2.2804   2.8150   482.55   17.505   15.135   34.337
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
5.8673   .00000   18.456   116.63   26.465   520.02   6.3775   22.308   66.189   13.074
  P        PB       SB       SE       SN       TI       TL       Y        ZN
289.59   45.923   82.161   .57009   .35355   3.8793   78.089   3.4893   28.887

DETECTION LIMIT          N=5      ALL2    7-JUN-88 17:19:41
  LV
1.0947
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
38.016   9.3005   17.627   50679.   4.5607   5.6300   965.10   35.010   30.271   68.674
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
11.735   .00000   36.912   233.26   52.929   1040.0   12.755   44.615   132.38   26.148
  P        PB       SB       SE       SN       TI       TL       Y        ZN
579.17   91.846   164.32   1.1402   .70711   7.7587   156.18   6.9785   57.774

% RELATIVE STANDARD DEVIATION   N=5      ALL2    7-JUN-88 17:19:44
  LV
.01084
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
463.61   35.771   979.26   5.0175   .77881   .33932   .06430   -921.3   .27058   .44332
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-5.514   .00000   .41077   205.33   .34520   .34967   .18115   -.6615   5.3634   -688.1
  P        PB       SB       SE       SN       TI       TL       Y        ZN
54.058   61.725   .81980   -190.0   .00000   .27811   .80710   -3.612   .25701
SAT>PC
ENTER SAMPLE NAME>09181
ENTER CLASS NAME>1/10
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5      ALL2    7-JUN-88 17:22:46
BLANK SUBTRACTED
  LV
5049.2
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-.2840   123.15   1.3033   -1.236   1.2095   .03681   8.8527   -.0092   .06604   .22680
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-2.651   .00000   85.963   .00724   18.608   7.5933   .14461   -.2168   1.6264   .13282
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.41774   .12657   .49151   -.7589   14.987   8.4774   .23818   .02396   .38648
```

```
STANDARD DEVIATION        N=5     ALL2    7-JUN-88 17:22:51
BLANK SUBTRACTED
  LV
1.1508
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.01596   .54511   .01667   .27275   .00807   .00038   .06480   .00114   .00043   .00202
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.01669   .00000   .37696   .01132   .37805   .02226   .00051   .00527   .01703   .00123
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.02516   .00882   .02683   .00328   13.681   .04996   .01354   .00057   .00153

DETECTION LIMIT           N=5     ALL2    7-JUN-88 17:23:01
BLANK SUBTRACTED
  LV
2.3017
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.03193   1.0902   .03334   .54550   .01615   .00075   .12959   .00229   .00087   .00405
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.03337   .00000   .75393   .02264   .75610   .04452   .00103   .01054   .03407   .00245
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.05031   .01763   .05366   .00655   27.363   .09991   .02709   .00114   .00306

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:23:13
BLANK SUBTRACTED
  LV
.02279
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-5.620   .44262   1.2792   -22.07   .66762   1.0233   .73192   -12.37   .65693   .89200
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-.6294   .00000   .43852   156.45   2.0317   .29314   .35525   -2.432   1.0473   .92351
  P        PB       SB       SE       SN       TI       TL       Y        ZN
6.0220   6.9656   5.4583   -.4316   91.287   .58929   5.6864   2.3859   .39647

MEAN     N=5     ALL2    7-JUN-88 17:23:29
  LV
5049.2
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-638.0   22966.   482.70   ******   6631.3   4326.1   53777.   -163.9   6902.8   9609.2
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-5699.   .00000   24491.   266.00   8906.9   ******   7913.6   -5160.   5253.2   728.70
  P        PB       SB       SE       SN       TI       TL       Y        ZN
6592.4   1484.2   12243.   .10000   .30000   63552.   12422.   121.50   33552.

STANDARD DEVIATION        N=5     ALL2    7-JUN-88 17:23:31
  LV
1.1508
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
36.890   100.54   6.3894   2253.9   43.605   18.444   386.33   17.289   7.5952   17.548
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
36.778   .00000   85.689   115.16   27.539   444.28   20.963   39.524   50.831   6.9965
  P        PB       SB       SE       SN       TI       TL       Y        ZN
389.78   35.815   78.547   .22361   .27386   369.28   52.589   3.1623   96.259
```

```
DETECTION LIMIT          N=5     ALL2    7-JUN-88 17:23:34
  LV
2.3017
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
73.780   201.08   12.779   4507.9   87.209   36.888   772.66   34.579   15.190   35.096
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
73.557   .00000   171.38   230.33   55.077   888.56   41.925   79.048   101.66   13.993
  P        PB       SB       SE       SN       TI       TL        Y       ZN
779.56   71.630   157.09   .44721   .54772   738.56   105.18   6.3245   192.52

% RELATIVE STANDARD DEVIATION    N=5     ALL2    7-JUN-88 17:23:38
  LV
.02279
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-5.782   .43779   1.3237   .32834   .65756   .42634   .71839   -10.55   .11003   .18262
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.6453   .00000   .34989   43.295   .30918   .28409   .26489   -.7660   .96762   .96014
  P        PB       SB       SE       SN       TI       TL        Y       ZN
5.9126   2.4131   .64155   223.61   91.287   .58107   .42334   2.6027   .28690
SAT>PC
ENTER SAMPLE NAME>09182
ENTER CLASS NAME>1/10
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 17:26:35
BLANK SUBTRACTED
  LV
5050.5
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-.6937   66.594   .69498   -.7352   1.2024   .00711   72.547   .03872   .12638   .43129
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-5.949   .00000   18.668   .00728   14.475   14.412   1.8359   -.1014   19.679   .24237
  P        PB       SB       SE       SN       TI       TL        Y       ZN
1.7484   2.1032   .84268   -.3530   -4.997   21.599   .29037   -.0008   6.5409

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 17:26:40
BLANK SUBTRACTED
  LV
.93541
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.01703   .33244   .01139   .37824   .00649   .00008   .17728   .00095   .00132   .00390
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.03456   .00000   .13102   .01350   .13874   .07417   .00992   .00275   .11764   .00251
  P        PB       SB       SE       SN       TI       TL        Y       ZN
.02547   .01091   .02855   .00166   27.357   .13616   .02458   .00062   .02911

DETECTION LIMIT          N=5     ALL2    7-JUN-88 17:26:50
BLANK SUBTRACTED
  LV
1.8708
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.03406   .66488   .02278   .75648   .01298   .00016   .35457   .00190   .00264   .00780
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.06912   .00000   .26204   .02700   .27748   .14833   .01983   .00550   .23528   .00502
  P        PB       SB       SE       SN       TI       TL        Y       ZN
.05093   .02182   .05710   .00333   54.714   .27233   .04916   .00124   .05823
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:27:03
BLANK SUBTRACTED
  LV
.01852
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
-2.455  .49920  1.6391  -51.45  .53986  1.0905  .24437  2.4515  1.0427  .90461
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
-.5809  .00000  .70183  185.46  .95846  .51461  .54011  -2.712  .59778  1.0360
   P      PB      SB      SE      SN      TI      TL       Y      ZN .
1.4565  .51881  3.3882  -.4711  -547.5  .63043  8.4658  -82.05  .44511

MEAN    N=5     ALL2    7-JUN-88 17:27:18
  LV
5050.5
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
-1586.  12425.  249.00  ******  6594.5  1522.2  ******  560.10  7813.0  11305.
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
******  .00000  8682.8  266.50  8616.7  ******  70291.  -4304.  58591.  1354.8
   P      PB      SB      SE      SN      TI      TL       Y      ZN
27236.  8559.7  12710.  .10000  -.1000  ******  11498.  -14.50  ******

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 17:27:21
  LV
.93541
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
39.613  60.963  4.4159  2945.3  34.934  5.0819  1044.0  14.245  23.524  32.652
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
73.387  .00000  30.238  137.32  11.200  1504.8  366.91  20.834  345.67  14.268
   P      PB      SB      SE      SN      TI      TL       Y      ZN
397.65  42.248  83.878  .22361  .54772  1007.5  102.01  3.4095  1737.8

DETECTION LIMIT         N=5     ALL2    7-JUN-88 17:27:24
  LV
1.8708
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
79.226  121.93  8.8318  5890.5  69.868  10.164  2088.0  28.490  47.048  65.303
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
146.77  .00000  60.476  274.64  22.401  3009.7  733.81  41.668  691.34  28.536
   P      PB      SB      SE      SN      TI      TL       Y      ZN
795.30  84.497  167.76  .44721  1.0954  2015.0  204.02  6.8191  3475.5

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:27:27
  LV
.01852
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
-2.497  .49064  1.7735  .43150  .52974  .33385  .23734  2.5433  .30109  .28883
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
-.5740  .00000  .34825  51.528  .12999  .50733  .52198  -.4841  .58996  1.0531
   P      PB      SB      SE      SN      TI      TL       Y      ZN
1.4600  .49357  .65992  223.61  -547.7  .62228  .88722  -23.51  .43039
SAT>PC
ENTER SAMPLE NAME>09183
ENTER CLASS NAME>1/10
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>
```

```
MEAN     N=5      ALL2     7-JUN-88 17:30:10
BLANK SUBTRACTED
  LV
5048.8
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
-.4288   47.856   .53149   -.8739   .39517   .00302   121.51   .07879   .04322   .17026
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-3.870   -.0000   7.8339   .02554   11.468   9.0007   .79589   -.0966   14.235   .07078
  P        PB       SB       SE       SN       TI       TL        Y       ZN
.88669   2.1664   .91257   -.2730   -4.995   12.975   .21649   -.0137   6.9793

STANDARD DEVIATION       N=5      ALL2     7-JUN-88 17:30:14
BLANK SUBTRACTED
  LV
.44697
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
.00553   .21552   .02880   .17900   .00185   .00005   .30233   .00125   .00086   .00185
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.02854   .00001   .04372   .01010   .07644   .04144   .00312   .00415   .03031   .00180
  P        PB       SB       SE       SN       TI       TL        Y       ZN
.01569   .01848   .05934   .00084   20.899   .05328   .02213   .00071   .02986

DETECTION LIMIT          N=5      ALL2     7-JUN-88 17:30:25
BLANK SUBTRACTED
  LV
.89394
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
.01107   .43105   .05761   .35800   .00370   .00009   .60466   .00250   .00173   .00370
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.05709   .00001   .08745   .02020   .15287   .08287   .00625   .00830   .06063   .00360
  P        PB       SB       SE       SN       TI       TL        Y       ZN
.03139   .03695   .11868   .00169   41.797   .10656   .04426   .00142   .05971

% RELATIVE STANDARD DEVIATION   N=5      ALL2     7-JUN-88 17:30:37
BLANK SUBTRACTED
  LV
.00885
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
-1.291   .45036   5.4193   -20.48   .46846   1.5079   .24880   1.5876   1.9995   1.0853
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.7376   -136.9   .55813   39.554   .66651   .46036   .39237   -4.296   .21294   2.5436
  P        PB       SB       SE       SN       TI       TL        Y       ZN
1.7700   .85278   6.5023   -.3087   -418.4   .41063   10.222   -5.174   .42777

MEAN     N=5      ALL2     7-JUN-88 17:30:53
  LV
5048.8
  AG       AL       AS        B        BA       BE       CA       CD       CO       CR
-972.8   8928.1   186.10   ******   2173.4   1105.3   ******   1164.6   6301.0   9140.5
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-8315.   -.2000   6134.7   452.10   8401.0   ******   31619.   -4267.   42492.   374.30
  P        PB       SB       SE       SN       TI       TL        Y       ZN
13864.   8656.7   12763.   -.1000   -.1000   97242.   10956.   -85.90   ******
```

```
STANDARD DEVIATION       N=5      ALL2    7-JUN-88 17:30:55
  LV
.44697
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
12.795   40.395   11.076   1417.3   10.188   2.2803   1837.2   18.879   15.285   14.822
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
61.505   .27386   10.092   102.76   4.9117   852.73   116.00   30.876   90.615   10.275
   P       PB       SB       SE       SN       TI       TL        Y       ZN
242.97   69.452   169.97   .22361   .41833   401.49   90.496   3.9115   1808.6

DETECTION LIMIT           N=5      ALL2    7-JUN-88 17:30:59
  LV
.89394
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
25.589   80.789   22.152   2834.6   20.376   4.5606   3674.5   37.758   30.570   29.643
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
123.01   .54772   20.184   205.51   9.8234   1705.5   232.00   61.752   181.23   20.550
   P       PB       SB       SE       SN       TI       TL        Y       ZN
485.93   138.90   339.94   .44721   .83666   802.97   180.99   7.8230   3617.1

% RELATIVE STANDARD DEVIATION    N=5      ALL2    7-JUN-88 17:31:02
  LV
.00885
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-1.315   .45244   5.9516   .20737   .46876   .20631   .24948   1.6211   .24258   .16215
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.7397   -136.9   .16451   22.729   .05847   .46019   .36687   -.7236   .21325   2.7451
   P       PB       SB       SE       SN       TI       TL        Y       ZN
1.7525   .80229   1.3317   -223.6   -418.3   .41287   .82599   -4.554   .42071
SAT>PC
ENTER SAMPLE NAME>09184
ENTER CLASS NAME>STRT
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5      ALL2    7-JUN-88 17:33:33
BLANK SUBTRACTED
  LV
5049.5
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
-.0064   .29175   .10805   24.099   .06292   .00011   129.30   .00197   .00180   -.0038
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
-.0900   -.0000   1.1749   -.0120   .37284   16.751   .07840   .03362   .35871   .00997
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.06515   -.0113   .12416   -.0765   4.9955   .32870   -.0175   -.0317   .04220

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 17:33:37
BLANK SUBTRACTED
  LV
1.0000
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.01554   .28610   .03590   1.4967   .00135   .00005   1.6186   .00074   .00076   .00227
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.00473   .00001   .16386   .01076   .30898   1.2315   .00338   .00398   .02245   .00321
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.02235   .01355   .01579   .00237   11.170   .00157   .01470   .00561   .00032
```

```
DETECTION LIMIT          N=5     ALL2    7-JUN-88 17:33:48
BLANK SUBTRACTED
  LV
2.0000
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.03108  .57220  .07179  2.9934  .00269  .00009  3.2371  .00148  .00152  .00454
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.00946  .00001  .32772  .02153  .61797  2.4630  .00676  .00796  .04491  .00641
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.04470  .02710  .03158  .00474  22.341  .00314  .02939  .01121  .00065

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:34:00
BLANK SUBTRACTED
  LV
.01980
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
-243.8  98.062  33.223  6.2107  2.1377  44.422  1.2518  37.586  42.272  -60.32
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-5.259  -223.6  13.947  -89.82  82.874  7.3517  4.3118  11.832  6.2599  32.161
  P        PB       SB       SE       SN       TI       TL       Y        ZN
34.309  -119.4  12.717  -3.097  223.61  .47781  -83.84  -17.66  .76833

MEAN     N=5     ALL2    7-JUN-88 17:34:16
  LV
5049.5
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
4.5000  62.000  23.400  ******  354.80  829.00  ******  5.3000  5527.2  7701.3
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-197.7  -.1000  4571.0  70.500  7617.0  ******  4897.2  -3300.  1508.8  27.000
  P        PB       SB       SE       SN       TI       TL       Y        ZN
1124.4  43.300  10181.  -.5000  .10000  2499.4  9639.7  -185.0  11462.

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 17:34:18
  LV
1.0000
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
35.965  53.344  13.790  12140.  7.3621  4.8734  9816.3  11.150  12.553  17.545
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
10.189  .22361  38.450  109.49  21.067  25318.  126.67  29.519  66.382  18.313
  P        PB       SB       SE       SN       TI       TL       Y        ZN
346.78  50.549  45.205  .00000  .22361  11.431  59.513  30.877  22.270

DETECTION LIMIT          N=5     ALL2    7-JUN-88 17:34:21
  LV
2.0000
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
71.931  106.69  27.581  24280.  14.724  9.7468  19633.  22.300  25.105  35.090
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
20.379  .44721  76.901  218.98  42.135  50636.  253.34  59.038  132.76  36.626
  P        PB       SB       SE       SN       TI       TL       Y        ZN
693.56  101.10  90.409  .00000  .44721  22.862  119.03  61.754  44.540
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:34:25
  LV
.01980
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
799.23   86.039   58.933   2.5246   2.0750   .58786   1.2526   210.38   .22711   .22782
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
-5.154   -223.6   .84118   155.31   .27658   7.3463   2.5866   -.8945   4.3997   67.827
  P        PB       SB       SE       SN       TI       TL       Y        ZN
30.841   116.74   .44401   .00000   223.61   .45736   .61738   -16.69   .19429
BAT>PC
ENTER SAMPLE NAME>09185
ENTER CLASS NAME>STRT
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 17:37:04
BLANK SUBTRACTED
  LV
3048.5
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.06672   .03805   .13252   14.487   .00996   .08031   .15458   .10149   .10827   .09216
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.10213   .00000   -.0580   .23780   -.6108   .01900   .00056   .00834   -.1000   .00466
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.01919   .34074   .09926   -.0000   -9.993   .00858   .08154   .00659   .18508

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 17:37:09
BLANK SUBTRACTED
  LV
.79057
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.01601   .01426   .02311   .92082   .00023   .00021   .00741   .00139   .00076   .00261
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.00586   .00000   .05360   .00442   .28827   .00032   .00014   .00254   .01735   .00227
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.01068   .00854   .04591   .00022   13.683   .00050   .02642   .00060   .00064

DETECTION LIMIT         N=5     ALL2    7-JUN-88 17:37:19
BLANK SUBTRACTED
  LV
1.5811
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
.03202   .02852   .04623   1.8416   .00046   .00042   .01483   .00277   .00152   .00522
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
.01172   .00000   .10720   .00884   .57653   .00064   .00027   .00507   .03470   .00455
  P        PB       SB       SE       SN       TI       TL       Y        ZN
.02136   .01708   .09182   .00045   27.366   .00100   .05283   .00120   .00128

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:37:31
BLANK SUBTRACTED
  LV
.01566
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
23.991   37.466   17.442   6.3564   2.2997   .26130   4.7961   1.3654   .70312   2.8346
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
5.7367   .00000   -92.49   1.8584   -47.20   1.6861   24.461   30.426   -17.35   48.755
  P        PB       SB       SE       SN       TI       TL       Y        ZN
55.645   2.5063   46.251   -729.5   -136.9   5.8199   32.396   9.1142   .34715
```

```
MEAN     N=5      ALL2     7-JUN-88 17:37:47
  LV
5048.5
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
173.70    14.700    32.800    ******    64.800    4863.8    1067.4    1507.1    7415.3    8493.6
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
214.90    .00000    4280.5    2610.8    7545.9    703.10    2004.2    -3487.    153.70    -3.300
  P         PB        SB        SE        SN        TI        TL        Y         ZN
411.60    1376.4    10080.    .00000    -.2000    100.80    10011.    25.900    20059.

STANDARD DEVIATION       N=5      ALL2     7-JUN-88 17:37:49
  LV
.79057
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
37.050    2.6599    8.8783    7388.2    1.2550    9.2909    45.026    20.695    12.412    21.579
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
12.592    .00000    13.024    45.128    20.348    6.6559    4.9192    18.555    51.233    12.984
  P         PB        SB        SE        SN        TI        TL        Y         ZN
165.58    32.221    130.62    .00000    .27386    3.7517    108.96    3.3053    36.019

DETECTION LIMIT          N=5      ALL2     7-JUN-88 17:37:52
  LV
1.5811
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
74.100    5.3198    17.757    14776.    2.5100    18.582    90.051    41.391    24.825    43.157
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
25.183    .00000    26.048    90.257    40.695    13.312    9.8385    37.111    102.47    25.967
  P         PB        SB        SE        SN        TI        TL        Y         ZN
331.16    64.441    261.24    .00000    .54772    7.5033    217.92    6.6106    72.039

% RELATIVE STANDARD DEVIATION   N=5      ALL2     7-JUN-88 17:37:56
  LV
.01566
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
21.330    18.094    27.068    1.3222    1.9367    .19102    4.2182    1.3732    .16739    .25406
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
5.8593    .00000    .30426    1.7285    .26965    .94665    .24545    -.5321    33.333    -393.4
  P         PB        SB        SE        SN        TI        TL        Y         ZN
40.228    2.3409    1.2958    .00000    -136.9    3.7219    1.0884    12.762    .17956
SAT>PC
ENTER SAMPLE NAME>09186
ENTER CLASS NAME>STRT
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5      ALL2     7-JUN-88 17:40:37
BLANK SUBTRACTED
  LV
5048.6
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
.01166    .03805    .03518    10.621    .00999    .00017    .03771    .00069    .00827    -.0064
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
.00495    .00000    -.0638    -.0128    -.2850    .01714    .00079    .00102    .02454    .00424
  P         PB        SB        SE        SN        TI        TL        Y         ZN
-.0001    .00503    .14728    .00005    -14.99    .00816    .02338    .00112    .03494
```

```
STANDARD DEVIATION       N=5      ALL2    7-JUN-88 17:40:42
BLANK SUBTRACTED
  LV
.54770
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
.01441    .02673    .01456    .81283    .00041    .00002    .00077    .00117    .00046    .00359
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
.00656    .00000    .01596    .00600    .29125    .00012    .00013    .00163    .01418    .00423
  P         PB        SB        SE        SN        TI        TL        Y         ZN
.01726    .01200    .03336    .00015    13.681    .00099    .00450    .00132    .00045

DETECTION LIMIT          N=5      ALL2    7-JUN-88 17:40:52
BLANK SUBTRACTED
  LV
1.0954
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
.02881    .05346    .02912    1.6257    .00083    .00004    .00155    .00234    .00091    .00719
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
.01311    .00000    .03193    .01200    .58249    .00024    .00025    .00326    .02836    .00846
  P         PB        SB        SE        SN        TI        TL        Y         ZN
.03451    .02399    .06672    .00030    27.363    .00197    .00900    .00264    .00090

% RELATIVE STANDARD DEVIATION   N=5      ALL2    7-JUN-88 17:41:05
BLANK SUBTRACTED
  LV
.01085
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
123.52    70.241    41.393    7.6533    4.1368    13.059    2.0490    168.45    5.5056    -56.15
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
132.54    .00000    -25.01    -46.93    -102.2    .69220    15.922    159.33    57.778    99.739
  P         PB        SB        SE        SN        TI        TL        Y         ZN
******    238.44    22.651    282.94    -91.29    12.089    19.254    118.07    1.2904

MEAN     N=5      ALL2    7-JUN-88 17:41:20
  LV
5048.6
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
46.300    14.700    -4.600    ******    65.000    808.10    359.30    -13.90    5638.6    7678.1
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
6.2000    .00000    4279.2    62.300    7569.1    664.90    2012.8    -3542.    521.60    -5.700
  P         PB        SB        SE        SN        TI        TL        Y         ZN
112.10    103.50    10218.    .00000    -.3000    97.700    9773.1    -4.200    11010.

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 17:41:23
  LV
.54770
  AG        AL        AS        B         BA        BE        CA        CD        CO        CR
33.333    4.9825    5.5946    6563.7    2.2638    1.3875    4.6449    17.626    7.9641    29.622
  CU        FE        FE        HG        K         MG        MN        MO        NA        NI
14.083    .00000    3.7016    61.041    20.897    2.4341    4.7909    12.425    41.898    24.165
  P         PB        SB        SE        SN        TI        TL        Y         ZN
267.56    45.649    96.164    .00000    .27386    7.3960    19.041    7.2509    27.911
```

```
DETECTION LIMIT         N=5     ALL2    7-JUN-88 17:41:26
  LV
1.0954
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
66.666  9.9649  11.189  13127.  4.5277  2.7750  9.2898  35.252  15.928  59.243
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
28.166  .00000  7.4031  122.08  41.794  4.8683  9.5819  24.850  83.796  48.330
   P      PB      SB      SE      SN      TI      TL       Y      ZN
535.12  91.299  192.33  .00000  .54772  14.792  38.081  14.502  55.823

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:41:29
  LV
.01085
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
71.993  33.894  -121.6  1.1122  3.4828  .17170  1.2928  -126.8  .14124  .38579
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
227.14  .00000  .08650  97.978  .27608  .36609  .23802  -.3508  8.0326  -423.9
   P      PB      SB      SE      SN      TI      TL       Y      ZN
238.68  44.106  .94110  .00000  -91.29  7.5701  .19483  -172.6  .25350
SAT>PC
ENTER SAMPLE NAME>09187
ENTER CLASS NAME>1/10
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 17:44:01
BLANK SUBTRACTED
  LV
5049.0
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.02510  .02303  .14371  -1.051  .00146  .08032  .10609  .10471  .11645  .10893
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.10161  -.0000  .21863  .23125  .66752  .00302  .00044  -.0937  .00553  .00310
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.02072  3.6724  .51922  -.0009  .00000  .00205  .26602  .00560  .19305

STANDARD DEVIATION      N=5     ALL2    7-JUN-88 17:44:05
BLANK SUBTRACTED
  LV
.61237
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.01305  .02526  .02880  .15697  .00036  .00022  .00041  .00114  .00061  .00206
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.00348  .00001  .03525  .00714  .21139  .00004  .00014  .00854  .00750  .00179
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.01709  .00477  .05164  .00015  .00000  .00078  .03112  .00044  .00059

DETECTION LIMIT         N=5     ALL2    7-JUN-88 17:44:15
BLANK SUBTRACTED
  LV
1.2247
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.02611  .05052  .05760  .31394  .00071  .00045  .00083  .00229  .00123  .00413
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.00695  .00001  .07051  .01428  .42279  .00007  .00028  .01708  .01500  .00358
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.03418  .00953  .10328  .00030  .00000  .00155  .06225  .00088  .00118
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:44:28
BLANK SUBTRACTED
  LV
.01213
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
52.005   109.70   20.042   -14.93   24.478   .27887   .38900   1.0929   .52670   1.8946
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
3.4205   -223.6   16.125   3.0870   31.669   1.2157   32.010   -9.117   135.54   57.637
  P        PB       SB       SE       SN       TI       TL       Y        ZN
82.489   .12977   9.9452   -17.11   .00000   37.884   11.700   7.8626   .30444

MEAN     N=5      ALL2     7-JUN-88 17:44:43
  LV
5049.0
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
77.400   11.900   37.100   ******   18.300   4870.2   773.70   1555.9   7562.0   8633.3
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
213.80   -.1000   4345.9   2544.5   7637.1   374.70   2001.2   -4245.   465.50   -12.20
  P        PB       SB       SE       SN       TI       TL       Y        ZN
435.30   14010.   11286.   .00000   .00000   51.900   10771.   20.500   20544.

STANDARD DEVIATION       N=5      ALL2     7-JUN-88 17:44:46
  LV
.61237
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
30.215   4.7090   11.065   1280.0   1.9558   12.070   2.4136   17.111   11.472   17.640
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
7.4716   .22361   8.7271   72.834   15.465   .75829   5.3921   63.775   22.153   10.220
  P        PB       SB       SE       SN       TI       TL       Y        ZN
265.08   19.499   148.45   .00000   .00000   5.8245   127.09   2.4238   36.949

DETECTION LIMIT          N=5      ALL2     7-JUN-88 17:44:49
  LV
1.2247
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
60.429   9.4181   22.129   2560.0   3.9115   24.140   4.8271   34.223   22.945   35.280
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
14.943   .44721   17.454   145.67   30.931   1.5166   10.784   127.55   44.306   20.440
  P        PB       SB       SE       SN       TI       TL       Y        ZN
530.16   38.998   296.90   .00000   .00000   11.649   254.18   4.8477   73.898

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:44:52
  LV
.01213
  AG       AL       AS       B        BA       BE       CA       CD       CO       CR
39.037   39.572   29.824   .18688   10.687   .24784   .31195   1.0998   .15171   .20433
  CU       FE       FE       HG       K        MG       MN       MO       NA       NI
3.4947   -223.6   .20081   2.8624   .20250   .20237   .26944   -1.502   4.7590   -83.77
  P        PB       SB       SE       SN       TI       TL       Y        ZN
60.896   .13917   1.3154   .00000   .00000   11.223   1.1800   11.824   .17985
SAT>PC
ENTER SAMPLE NAME>INTF
ENTER CLASS NAME>CKSTD
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>
```

```
MEAN     N=5     ALL2    7-JUN-88 17:47:18
BLANK SUBTRACTED
  LV
5049.5
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.82160  100.29  2.1922  11.335  1.0114  .83990  77.595  1.0064  1.0209  1.0690
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.67666  .00000  103.17  1.2034  102.69  1.8800  .89143  .93987  99.290  1.0279
   P      PB      SB      SE      SN      TI      TL       Y      ZN
35.004  1.0925  1.3681  -.7695  -4.995  .98987  1.0992  .98188  1.6657

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 17:47:22
BLANK SUBTRACTED
  LV
1.2743
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.01433  .62705  .01987  3.8128  .00604  .00502  .28476  .00719  .00645  .00659
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.00802  .00001  .61189  .02395  .58676  .01286  .00571  .00524  .32097  .00918
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.05983  .01778  .04030  .00437  27.359  .00666  .02952  .00700  .00953

DETECTION LIMIT          N=5     ALL2    7-JUN-88 17:47:33
BLANK SUBTRACTED
  LV
2.5486
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.02867  1.2541  .03974  7.6257  .01207  .01004  .56952  .01439  .01289  .01318
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.01605  .00002  1.2238  .04790  1.1735  .02572  .01143  .01048  .64194  .01836
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.11966  .03555  .08059  .00874  54.718  .01332  .05905  .01400  .01905

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:47:45
BLANK SUBTRACTED
  LV
.02524
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
1.7446  .62526  .90642  33.637  .59670  .59759  .36698  .71482  .63132  .61646
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
1.1858  223.61  .59310  1.9903  .57137  .68404  .64095  .55741  .32327  .89293
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.17092  1.6270  2.9453  -.5681  -547.7  .67298  2.6858  .71285  .57185

MEAN     N=5     ALL2    7-JUN-88 17:48:00
  LV
5049.5
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
1920.7  18704.  824.30  ******  5547.5  45310.  ******  15164.  23895.  16581.
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
1449.0  .20000  28535.  12434.  14858.  38957.  35639.  3431.6  ******  5841.5
   P      PB      SB      SE      SN      TI      TL       Y      ZN
******  4976.8  14670.  .10000  -.1000  7453.4  16032.  5393.4  ******
```

```
STANDARD DEVIATION       N=5     ALL2    7-JUN-88 17:48:03
  LV
1.2743
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
32.796  113.34  7.7830  30895.  31.889  257.05  1703.5  106.27  112.70  51.863
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
16.963  .44721  139.59  243.59  39.931  256.82  208.05  38.882  886.03  52.102
   P      PB      SB      SE      SN      TI      TL       Y      ZN
1022.0  68.548  119.24  .22361  .54772  48.449  129.44  37.442  564.15

DETECTION LIMIT          N=5     ALL2    7-JUN-88 17:48:06
  LV
2.5486
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
65.592  226.68  15.566  61791.  63.778  514.11  3407.0  212.55  225.40  103.73
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
33.927  .89443  279.18  487.17  79.862  513.64  416.10  77.764  1772.1  104.20
   P      PB      SB      SE      SN      TI      TL       Y      ZN
2044.0  137.10  238.49  .44721  1.0954  96.898  258.88  74.884  1128.3

% RELATIVE STANDARD DEVIATION    N=5     ALL2    7-JUN-88 17:48:10
  LV
.02524
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
1.7075  .60598  .94420  5.2861  .57484  .56733  .36216  .70081  .47164  .31278
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
1.1707  223.61  .48920  1.9591  .26875  .65925  .58377  1.1331  .30164  .89193
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.18822  1.3774  .81286  223.61  -547.7  .65002  .80740  .69422  .50943
SAT>PC
ENTER SAMPLE NAME>5PPM
ENTER CLASS NAME>M,RI5
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN    N=5     ALL2    7-JUN-88 17:50:53
BLANK SUBTRACTED
  LV
5048.9
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
4.9998  -.0446  .02738  .36681  .00122  4.0196  4.8423  5.0530  5.1331  5.0637
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
4.9718  -.0000  5.9251  -.0189  .43084  .00018  .00091  -.0995  .02511  .00881
   P      PB      SB      SE      SN      TI      TL       Y      ZN
1.8319  5.4326  .46504  -.0226  -4.997  .00206  5.4804  5.0197  8.1572

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 17:50:58
BLANK SUBTRACTED
  LV
.74160
  AG      AL      AS       B      BA      BE      CA      CD      CO      CR
.02578  .01099  .03575  .93922  .00034  .01549  .02448  .01943  .02304  .02578
  CU      FE      FE      HG       K      MG      MN      MO      NA      NI
.02792  .00001  .04810  .00797  .38467  .00015  .00016  .00601  .01100  .00217
   P      PB      SB      SE      SN      TI      TL       Y      ZN
.01023  .01804  .02300  .00017  20.899  .00041  .05108  .02127  .02873
```

```
DETECTION LIMIT          N=5      ALL2     7-JUN-88 17:51:08
BLANK SUBTRACTED
  LV
1.4832
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
.05157    .02199    .07150    1.8784    .00068    .03099    .04895    .03885    .04608    .05156
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
.05583    .00001    .09620    .01594    .76933    .00031    .00032    .01202    .02201    .00433
   P        PB        SB        SE        SN        TI        TL         Y        ZN
.02046    .03608    .04599    .00033    41.798    .00093    .10217    .04254    .05745

% RELATIVE STANDARD DEVIATION   N=5      ALL2     7-JUN-88 17:51:21
BLANK SUBTRACTED
  LV
.01469
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
.51571    -24.27    130.60    254.05    27.962    .38547    .50548    .38446    .44988    .50913
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
.56148    -223.6    .81183    -42.22    39.283    85.557    17.919    -6.042    43.825    24.579
   P        PB        SB        SE        SN        TI        TL         Y        ZN
.55843    .33207    4.9449    -.7294    -418.3    20.075    .93214    .42377    .35215

MEAN     N=5      ALL2     7-JUN-88 17:51:36
  LV
5048.9
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
11589.    -.7000    -7.600    ******    17.000    ******    29473.    76231.    96722.    49642.
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
10673.    -.1000    5686.4    .40000    7620.2    316.40    2040.6    -4288.    523.30    20.400
   P        PB        SB        SE        SN        TI        TL         Y        ZN
28521.    20685.    11147.    .00000    -.1000    52.000    32190.    27612.    ******

STANDARD DEVIATION       N=5      ALL2     7-JUN-88 17:51:39
  LV
.74160
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
60.137    2.0494    13.740    7629.0    1.8708    793.86    150.08    290.65    415.00    216.88
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
60.603    .22361    10.686    81.094    26.867    3.1898    5.9937    44.755    32.467    12.371
   P        PB        SB        SE        SN        TI        TL         Y        ZN
157.96    69.251    66.649    .00000    .41833    3.1024    209.55    118.60    1765.2

DETECTION LIMIT          N=5      ALL2     7-JUN-88 17:51:42
  LV
1.4832
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
120.27    4.0988    27.481    15258.    3.7417    1587.7    300.16    581.29    829.99    433.76
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
121.21    .44721    21.371    162.19    53.733    6.3797    11.987    89.509    64.933    24.743
   P        PB        SB        SE        SN        TI        TL         Y        ZN
315.92    138.50    133.30    .00000    .83666    6.2048    419.10    237.19    3530.4
```

```
% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:51:45
  LV
.01469
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.51893  -292.8   -180.8   1.1329   11.005   .38847   .50922   .38127   .42906   .43689
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.56779  -223.6   .18791   20273.   .35257   1.0082   .29372   -1.044   6.2042   60.644
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.55383  .33480   .59792   .00000   -418.3   5.9662   .65099   .42952   .35257
SAT>PC
ENTER SAMPLE NAME>75PPM
ENTER CLASS NAME>MRI7
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5     ALL2    7-JUN-88 17:54:18
BLANK SUBTRACTED
  LV
5048.6
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.01663  74.097   .71760   3.8294   .00181   .02525   72.193   -.0079   .00373   .01881
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.01305  .00000   75.917   .00440   75.822   .00269   -.0034   -.1900   73.526   .00141
   P       PB       SB       SE       SN       TI       TL        Y       ZN
26.570  .01742   .31567   -.5757   9.9926   .00152   .07584   -.0154   .01999

STANDARD DEVIATION       N=5     ALL2    7-JUN-88 17:54:22
BLANK SUBTRACTED
  LV
.41815
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.01909  .56765   .03343   1.8846   .00078   .00019   .21279   .00136   .00091   .00162
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.00488  .00000   .52468   .00672   .48235   .00022   .00011   .01172   .52633   .00389
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.21968  .01029   .01867   .00402   22.342   .00113   .02155   .00138   .00048

DETECTION LIMIT          N=5     ALL2    7-JUN-88 17:54:33
BLANK SUBTRACTED
  LV
.83631
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.03818  1.1353   .06686   3.7691   .00156   .00037   .42559   .00271   .00181   .00323
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.00977  .00000   1.0494   .01344   .96469   .00045   .00022   .02343   1.0527   .00777
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.43937  .02058   .03734   .00803   44.684   .00227   .04310   .00275   .00096

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 17:54:45
BLANK SUBTRACTED
  LV
.00828
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
114.77  .76609   4.6588   49.213   43.271   .74161   .29476   -17.12   24.256   8.5942
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
37.427  .00000   .69112   152.82   .63615   8.2688   -3.178   -6.166   .71584   276.52
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.82681  59.062   5.9140   -.6977   223.59   74.795   28.411   -8.924   2.3986
```

```
MEAN     N=5      ALL2    7-JUN-88 17:55:01
  LV
5048.6
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
57.800    13819.    257.60    ******    20.200    3546.4    ******    -143.8    5748.6    7886.7
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
23.600    .00000    22128.    237.10    12954.    368.00    2293.5    -4960.    ******    -21.90
   P        PB        SB        SE        SN        TI        TL         Y        ZN
******    703.70    11404.    .00000    .20000    47.900    11354.    -95.20    11154.

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 17:55:03
  LV
.41815
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
44.174    106.51    12.862    15331.    4.2808    8.9393    1309.7    20.453    15.986    13.084
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
10.490    .00000    124.37    68.347    35.029    4.5962    5.1113    87.182    1561.3    22.199
   P        PB        SB        SE        SN        TI        TL         Y        ZN
3426.0    39.007    50.418    .00000    .44721    8.5029    93.485    7.5713    23.843

DETECTION LIMIT          N=5      ALL2    7-JUN-88 17:55:06
  LV
.83631
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
88.348    213.03    25.724    30661.    8.5615    17.879    2619.3    40.906    31.972    26.169
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
20.981    .00000    248.73    136.69    70.058    9.1923    10.223    174.36    3122.5    44.398
   P        PB        SB        SE        SN        TI        TL         Y        ZN
6852.0    78.015    100.84    .00000    .89443    17.006    186.97    15.143    47.686

% RELATIVE STANDARD DEVIATION   N=5      ALL2    7-JUN-88 17:55:10
  LV
.00828
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
76.425    .77077    4.9929    2.3758    21.192    .25207    .29931    -14.22    .27808    .16590
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
44.451    .00000    .56203    28.826    .27041    1.2490    .22286    -1.758    .71750    -101.4
   P        PB        SB        SE        SN        TI        TL         Y        ZN
.83131    5.5432    .44210    .00000    223.61    17.751    .82339    -7.953    .21376
SAT>PC
ENTER SAMPLE NAME>CAL
ENTER CLASS NAME>BLANK
ENTER SAMPLE CODE>
ENTER SAMPLE DIGIT>

MEAN     N=5      ALL2    7-JUN-88 17:59:52
BLANK SUBTRACTED
  LV
5047.4
  AG        AL        AS         B        BA        BE        CA        CD        CO        CR
.02027    .02519    .03466    -1.153    .00082    .00025    .00505    .00075    .00906    -.0013
  CU        FE        FE        HG         K        MG        MN        MO        NA        NI
.00257    .00000    -.0318    -.0051    .35677    .00077    -.0001    -.0976    .02678    .00226
   P        PB        SB        SE        SN        TI        TL         Y        ZN
-.0164    .00979    .50222    .00001    -.0005    .00156    .13445    .00173    .01579
```

```
STANDARD DEVIATION       N=5      ALL2    7-JUN-88 17:59:57
BLANK SUBTRACTED
  LV
.65190
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.01133  .00699  .01627  .19597  .00081  .00001  .00025  .00109  .00117  .00196
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.00412  .00001  .07930  .01039  .36232  .00008  .00009  .00469  .01629  .00347
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.01142  .00476  .03987  .00028  17.666  .00062  .02136  .00085  .00044

DETECTION LIMIT          N=5      ALL2    7-JUN-88 18:00:07
BLANK SUBTRACTED
  LV
1.3038
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
.02266  .01398  .03255  .39193  .00161  .00003  .00050  .00218  .00235  .00392
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
.00824  .00002  .15860  .02078  .72465  .00016  .00019  .00937  .03259  .00694
   P       PB       SB       SE       SN       TI       TL        Y       ZN
.02284  .00952  .07975  .00057  35.333  .00125  .04272  .00171  .00088

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 18:00:20
BLANK SUBTRACTED
  LV
.01292
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
55.907  27.750  46.963  -16.99  98.135  5.9138  4.9854  146.19  12.965  -151.4
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
160.05  ******  -249.1  -202.7  101.56  10.525  -106.3  -4.801  60.833  153.42
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-69.43  48.627  7.9397  2578.5  ******  40.006  15.888  49.259  2.7743

MEAN    N=5     ALL2    7-JUN-88 18:00:35
  LV
5047.4
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
66.200  12.300  -4.800  ******  14.800  812.40  161.40  -13.10  5651.2  7718.5
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
1.1000  .00000  4285.7  140.20  7612.7  328.40  1979.8  -4273.  528.10  -17.00
   P       PB       SB       SE       SN       TI       TL        Y       ZN
-141.0  121.40  11233.  .00000  .00000  48.200  10226.  -.8000  9853.8

STANDARD DEVIATION       N=5      ALL2    7-JUN-88 18:00:38
  LV
.65190
  AG       AL       AS        B       BA       BE       CA       CD       CO       CR
26.222  1.3038  6.2510  1567.3  4.4102  2.1036  1.5166  16.460  21.392  17.029
  CU       FE       FE       HG        K       MG       MN       MO       NA       NI
8.8417  .35355  19.042  105.65  26.534  1.6355  3.9938  34.863  48.154  19.827
   P       PB       SB       SE       SN       TI       TL        Y       ZN
177.03  17.998  113.62  .00000  .35355  4.6717  85.878  4.6984  27.460
```

```
DETECTION LIMIT          N=5     ALL2    7-JUN-88 18:00:41
  LV
1.3038
  AG      AL      AS       B       BA      BE      CA      CD      CO      CR
52.443  2.6077  12.502  3134.6  8.8204  4.2072  3.0332  32.920  42.784  34.059
  CU      FE      FE      HG       K       MG      MN      MO      NA      NI
17.683  .70711  38.083  211.30  53.069  3.2711  7.9875  69.726  96.308  39.655
   P      PB      SB      SE      SN      TI      TL       Y      ZN
354.07  35.996  227.24  .00000  .70711  9.3435  171.76  9.3968  54.920

% RELATIVE STANDARD DEVIATION   N=5     ALL2    7-JUN-88 18:00:44
  LV
.01292
  AG      AL      AS       B       BA      BE      CA      CD      CO      CR
39.610  10.600  -130.2  .22862  29.799  .25893  .93965  -125.6  .37854  .22063
  CU      FE      FE      HG       K       MG      MN      MO      NA      NI
803.79  .00000  .44430  75.355  .34855  .49803  .20173  -.8159  9.1183  -116.6
   P      PB      SB      SE      SN      TI      TL       Y      ZN
-125.6  14.825  1.0115  .00000  .00000  9.6924  .83983  -587.3  .27867
SAT>LO-
SAT>EX\\\
BYE

>
```

Project 8910L Part #2 Part LIX
Atomic Absorption Data Reporting
Sheet - As GFAA - 6-6-88
ELM McClendon 6-17-88
1357:40

ATOMIC ABSORPTION DATA REPORTING SHEET:

THE PERKIN - ELMER SYSTEM INCLUDES:

5000 ATOMIC ABSORPTION SPECTROPHOTOMETER
ZEEMAN 5000 GFAA ASSEMBLY
HGA 500 PROGRAMMER
AS 40 AUTO SAMPLER

ATOMIC SPECTROSCOPY DATA SYSTEM 10
PR-100 PRINTER
EDL POWER SUPPLY

PROJECT NUMBER: 8910L0213
LOT: Not Appl
DATA FILE: 606A
I.D. / WEIGHT FILE: NA

ANALYST: ELM McClendon
DATE: 6-6-88
ELEMENT: As
SAMPLE MATRIX: 0.05M H_3BO_3 / 10% HNO_3

INSTRUMENTAL PARAMETERS FOR THE 5000 ATOMIC ABSORPTION SPECTROPHOTOMETER:

TIME (sec.): 7.0
ENERGY: 48
LAMP SOURCE: EDL
HCL CURRENT (ma): NA
EDL POWER (w): 8
WAVELENGTH (nm): ~~1~~194.1
ELM 6-6-88

SLIT: H ___ L ✓
SLIT (nm): 0.7
INST. PROGRAM #: 1

MODE: ABSORBANCE ✓
CONCENTRATION ___
EMISSION ___

AA ___
AA - BG ___
BG ___
ZAA ✓

SIGNAL: CONTINUOUS ___
HOLD ___
PEAK HEIGHT ___
PEAK AREA ✓

RECORD DUPLICATES ___
RECORD ABSORBANCE ✓
RECORD AVERAGE ✓ (2)
COEFF. OF VARIATION ___

PARAMETERS FOR THE ZEEMAN 5000 - HGA 500 PROGRAMMER WITH AS 40 AUTO SAMPLER:

SAMPLE INJECTION VOLUME (mcL): 20
MATRIX MODIFIER: Ni(NO_3)$_2$ 1000ppm
MATRIX MODIFIER INJECTION VOLUME (mcL): 5

PURGE GAS ATMOSPHERE: Ar
TUBE: PYROLYTIC ✓
NON-PYROLYTIC ___
PLATFORM Y ✓ N ___

HGA PROGRAM #: 3

CYCLE	RAMP TIME (sec.)	HOLD TIME (sec.)	TEMPERATURE (C)	FLOW RATE (mL/min.)
STEP 1	1	ELM ~~4~~40 6-6-88	110	300
STEP 2	15	1	250	300
STEP 3	1	4	1400	300
STEP 4	1	4	2400	50
STEP 5				
STEP 6				

Rec -1 Baseline -1
Read 0

ADDITIONAL COMMENTS: Matrix Modifier 1000ppm Ni(NO_3)$_2$
Fisher AA Lot 863956-24

5311-AA-002

Project 89106 Part #2 Part IX
Sample Raw Data - As GFAA-6-6-88
ELMcClendon 6-17-88
1357:40

Atomic Absorption Worksheet

Project Number: 89106 0213
Analyst: ELMcClendon
Date/Time: 6-6-88/1025

Analyte: As
Data File: 606A
Inst./HGA Program #: 1/3

Cup #	Sample ID	Dilution	Abs.	Comments
AZ	0µg/L		-1.999 ✓ 0.000 ✓	
01	0µg/L		-0.002 ✓	
02	5µg/L		0.009 ✓	
03	10µg/L		0.018 ✓	
04	25µg/L		0.050 ✓	
05	50µg/L		0.098 ✓	
06	100µg/L		0.199 ✓	
07	250µg/L		0.498 ✓	
08	0µg/L		0.001 ✓	
09	NBS 1643b	1/2	0.062	✓ 63.36µg/L
10	100µg/L MRI2A	1/2	0.106	✓ 107µg/L
11	0µg/L		-0.001 ✓	
12	09168	1/10	0.001 ✓	
13	09169	1/10	0.060 ✓	
14	09170	1/10	0.067 ✓	
15	09171	1/10	0.095 ✓	
16	100µg/L		0.204	✓+ 2.51%
17	0µg/L		0.002 ✓	

Verified by ELMcClendon 6-14-88

Cup #	Sample ID	Dilution	Abs.	Comments
18	09172	1/10	0.271 ✓	
19	09173	1/10	0.024 ✓	
20	09174	1/10	0.010 ✓	
21	09175	1/10	0.007 ✓	
22	09176	1/10	0.032 ✓	
23	09177	1/10	0.065 ✓	
24	09178	1/10	0.097 ✓	
25	09179	1/10	0.030 ✓	
26	100µg/L		0.215 ✓	
27	0µg/L ~~09180~~		0.002 ✓	
28	09180	1/10	0.007 ✓	
29	09181 ~~09182~~	1/10	0.260 ✓	
30	09182 ~~09183~~	1/10	0.081 ✓	
31	09183 ~~09184~~	1/10	0.111 ✓	
32	09184 ~~09185~~	1/10	0.013 ✓	
33	09185 ~~09186~~	1/10	0.022 ✓	10
34	09186	1/10	0.002 ✓	
35	09187	1/10	0.235 ✓	
	100		0.227 ✓	
	0		0.003 ✓	
	5		0.014 ✓	6-6-88 ELMc
	5		~~0.013~~ 0.015 ✓	
	5		0.013 ✓	
	5		0.013 ✓	
	5		0.013 ✓	

ELMc 6-6-88

Linear Regression Data:

Correlation Coefficient = 0.9999908
Y-Intercept = -0.0013025
Slope = 0.0019980

Additional Comments: std range: .159 - .239

Project 8910c Part #2 Part LXI
Data Station 10 Output - As GFAA
6-6-88
Ed McClendon 6-17-88
1357:40

```
BEGIN DATA FILE:  606A.DF


Begin Element - AS
  -1.999
  -1.999
  -1.999 AV
   0.000 AZ
  -0.003
  -0.000
  -0.002 AV
   0.007
   0.010
   0.009 AV
   0.018
   0.018
   0.018 AV
   0.051
   0.048
   0.050 AV
   0.098
   0.098
   0.098 AV
   0.200
   0.198
   0.199 AV
   0.493
   0.503
   0.498 AV
   0.002
  -0.001
   0.001 AV
   0.060
   0.063
   0.062 AV
   0.105
   0.107
   0.106 AV
  -0.001
  -0.000
  -0.001 AV
   0.002
   0.001
   0.001 AV
   0.059
   0.062
   0.060 AV
   0.066
   0.068
   0.067 AV
   0.096
   0.094
   0.095 AV
   0.205
   0.203
   0.204 AV
   0.002
   0.002
   0.002 AV
   0.276
   0.267
   0.271 AV
   0.025
```

```
0.023
0.024 AV
0.010
0.009
0.010 AV
0.007
0.008
0.007 AV
0.032
0.032
0.032 AV
0.065
0.064
0.065 AV
0.100
0.095
0.097 AV
0.030
0.031
0.030 AV
0.223
0.207
0.215 AV
0.000
0.003
0.002 AV
0.007
0.007
0.007 AV
0.263
0.258
0.260 AV
0.082
0.080
0.081 AV
0.111
0.111
0.111 AV
0.013
0.013
0.013 AV
0.024
0.020
0.022 AV
0.002
0.002
0.002 AV
0.231
0.238
0.235 AV
0.226
0.229
0.227 AV
0.003
0.003
0.003 AV
0.014
0.013
0.014 AV
0.014
0.015
0.015 AV
0.012
```

```
0.014
0.013 AV
0.013
0.013
0.013 AV
0.012
0.014
0.013 AV
```

Project 89106 Part #2
Part LXII Atomic Absorption Data
Reporting Sheet - Pb GFAA - 6-6-88
E.L.McClendon 6-17-88
1357:40

ATOMIC ABSORPTION DATA REPORTING SHEET:

THE PERKIN - ELMER SYSTEM INCLUDES:

5000 ATOMIC ABSORPTION SPECTROPHOTOMETER
ZEEMAN 5000 GFAA ASSEMBLY
HGA 500 PROGRAMMER
AS 40 AUTO SAMPLER

ATOMIC SPECTROSCOPY DATA SYSTEM 10
PR-100 PRINTER
EDL POWER SUPPLY

PROJECT NUMBER: 89106 0213
LOT: Not Appl.
DATA FILE: 606B
I.D. / WEIGHT FILE: N/A

ANALYST: E.L.McClendon
DATE: 6-6-88
ELEMENT: Pb
SAMPLE MATRIX: 0.05M H_3BO_3 / 10% HNO_3

INSTRUMENTAL PARAMETERS FOR THE 5000 ATOMIC ABSORPTION SPECTROPHOTOMETER:

TIME (sec.): 2.0
ENERGY: 50
LAMP SOURCE: HCL
HCL CURRENT (ma): 15
EDL POWER (w): NA
WAVELENGTH (nm): 283.6

SLIT: H ___ L ✓
SLIT (nm): 0.7
INST. PROGRAM #: 1

MODE: ABSORBANCE ✓
CONCENTRATION ___
EMISSION ___

AA ___
AA - BG ___
BG ___
ZAA ✓

SIGNAL: CONTINUOUS ___
HOLD ___
PEAK HEIGHT ___
PEAK AREA ✓

RECORD DUPLICATES ___
RECORD ABSORBANCE ✓
RECORD AVERAGE ✓ (2)
COEFF. OF VARIATION ___

PARAMETERS FOR THE ZEEMAN 5000 - HGA 500 PROGRAMMER WITH AS 40 AUTO SAMPLER:

SAMPLE INJECTION VOLUME (mcL): 20
MATRIX MODIFIER: 4% H_3PO_4 (V/V)
MATRIX MODIFIER INJECTION VOLUME (mcL): 5

PURGE GAS ATMOSPHERE: Ar
TUBE: PYROLYTIC ✓
NON-PYROLYTIC ___
PLATFORM Y ✓ N ___

HGA PROGRAM #: 1

CYCLE	RAMP TIME (sec.)	HOLD TIME (sec.)	TEMPERATURE (C)	FLOW RATE (mL/min.)
STEP 1	1	30	120	300
STEP 2	10	20	700	300
STEP 3	1	4	2400	0
STEP 4	1	3	2700	300
STEP 5	15	15	20	300
STEP 6				

Rec -3
Read 0
Baseline -3

ADDITIONAL COMMENTS: H_3PO_4 Fisher ACS Lot 856829

Project 8910C Part #2 Part LXIII
Sample Raw Data - Pb GFAA-6-6-88
ELMcClendon 6-17-88
1357:40

Atomic Absorption Worksheet

Project Number: 89101 0213
Analyst: ELMcClendon
Date/Time: 6-6-88/1500

ELM 6-6-88
Analyte: ~~As~~ Pb
Data File: 606B
Inst./HGA Program #: 1/1

Verified by ELMcClendon 6-14-88

Cup #	Sample ID	Dilution	Abs.	Comments
AZ	0µg/L		-2.028 ✓ 0.000 ✓	
01	0µg/L		0.004	✓
02	5µg/L		0.030	✓
03	10µg/L		0.048	✓
04	25µg/L		0.119	✓
05	50µg/L		0.229	✓
06	100µg/L		0.422	✓
07	0µg/L		0.000	✓
08	NBS 1643b	1/2	0.061	✓ 24.6µg/L
09	100µg/L MET1A	1/2	0.225	✓ 103µg/L
10	0µg/L		0.001	✓
11	09168	1/10	0.005	✓
12	09174	1/10	0.003	✓
13	09175	1/10	0.002	✓
14	09176	1/10	0.095	✓
15	50µg/L		0.231	✓
16	0µg/L		0.001	✓
17	09180	1/10	0.002	✓

Cup #	Sample ID	Dilution	Abs.	Comments
18	09184	1/10	0.002	✓
19	09185	1/10	0.152	✓
20	09186	1/10	0.000	✓
21	50µg/L		0.232	✓
22	0µg/L		-0.002 ~~0.03~~	✓ ELM 6-6-88
23	5µg/L		0.034	✓
24	5µg/L		0.038	✓
25	5µg/L		0.057	✓
26	5µg/L		0.033	✓
27	5µg/L		0.032	✓
28				
29				
30				
31				
32				
33				
34				
35				

Linear Regression Data:

Correlation Coefficient = 0.9991863
Y-Intercept = 0.0094597
Slope = 0.0041855

Additional Comments:

Project 89106 Part #2 Part XXIV
Data Station 10 Output - Pb GFAA -
6-6-88
E H McClendon 6-17-88

1357:40

```
BEGIN DATA FILE:  606B.DF


Begin Element - PB
  -2.028
  -2.027
  -2.028 AV
   0.000 AZ
   0.003
   0.004
   0.004 AV
   0.030
   0.031
   0.030 AV
   0.048
   0.048
   0.048 AV
   0.118
   0.120
   0.119 AV
   0.232
   0.227
   0.229 AV
   0.421
   0.423
   0.422 AV
  -0.000
   0.001
   0.000 AV
   0.062
   0.060
   0.061 AV
   0.225
   0.226
   0.225 AV
   0.002
   0.001
   0.001 AV
   0.004
   0.006
   0.005 AV
   0.004
   0.002
   0.003 AV
   0.000
   0.003
   0.002 AV
   0.094
   0.095
   0.095 AV
   0.229
   0.233
   0.231 AV
   0.002
   0.001
   0.001 AV
   0.001
   0.003
   0.002 AV
   0.002
   0.002
   0.002 AV
   0.151
```

```
 0.152
 0.152 AV
 0.001
-0.001
 0.000 AV
 0.233
 0.230
 0.232 AV
-0.003
-0.001
-0.002 AV
 0.034
 0.033
 0.034 AV
 0.037
 0.039
 0.038 AV
 0.057
 0.057
 0.057 AV
 0.033
 0.033
 0.033 AV
 0.033
 0.031
 0.032 AV
```

Project 8910L Part#2 Part IXV
atomic absorption Data Reporting Sheet - Hg CVAAS - 6-7-88
EJMcClendon 6-17-88
1357:40

ATOMIC ABSORPTION DATA REPORTING SHEET:

THE PERKIN - ELMER SYSTEM INCLUDES:

5000 ATOMIC ABSORPTION SPECTROPHOTOMETER
ZEEMAN 5000 GFAA ASSEMBLY
HGA 500 PROGRAMMER
AS 40 AUTO SAMPLER

ATOMIC SPECTROSCOPY DATA SYSTEM 10
PR-100 PRINTER
EDL POWER SUPPLY

PROJECT NUMBER: 8910L07-13
LOT: NA
DATA FILE: 0607
I.D. / WEIGHT FILE: NA

ANALYST:
DATE: 6-7-88
ELEMENT: Hg
SAMPLE MATRIX: Ash

INSTRUMENTAL PARAMETERS FOR THE 5000 ATOMIC ABSORPTION SPECTROPHOTOMETER:

TIME (sec.): 30
ENERGY: 68
LAMP SOURCE: EDL
HCL CURRENT (ma): NA
EDL POWER (w): 5
WAVELENGTH (nm): 254.0

SLIT: H ___ L ✓
SLIT (nm): 0.7
INST. PROGRAM #: 2

MODE: ABSORBANCE ✓
CONCENTRATION ___
EMISSION ___

AA ✓
AA - BG ___
BG ___
ZAA ___

Reductant SnCl2 - 10% in 50%(v/v) HCl.

Reductant Volume = 6.1 mL

Purge Time = 12s

Purge Gas Atmosphere = Argon

SIGNAL: CONTINUOUS ___
HOLD ___
PEAK HEIGHT ✓
PEAK AREA ___

RECORD DUPLICATES ___
RECORD ABSORBANCE ✓
RECORD AVERAGE ___
COEFF. OF VARIATION ___

PARAMETERS FOR THE ZEEMAN 5000 - HGA 500 PROGRAMMER WITH AS 40 AUTO SAMPLER:

~~SAMPLE INJECTION VOLUME (mcL):~~ ___
MATRIX MODIFIER: ___
MATRIX MODIFIER INJECTION VOLUME (mcL): ___

~~PURGE GAS ATMOSPHERE:~~ ___
TUBE: PYROLYTIC ___
~~NON-PYROLYTIC~~ ___
PLATFORM Y ___ N ___

HGA PROGRAM #: ___

CYCLE	RAMP TIME (sec.)	HOLD TIME (sec.)	TEMPERATURE (C)	FLOW RATE (mL/min.)
STEP 1				
STEP 2				
STEP 3				
STEP 4				
STEP 5				
STEP 6				

NJ 6-7-88

ADDITIONAL COMMENTS:

Project 89106 Part #2 Part LXVI
Sample Raw Data - Hg CVAAS - 6-7-88
1 of 2
EH McClendon 6-17-88 1357:40

Atomic Absorption Worksheet

Project Number: 8910L02-13
Analyst:
Date/Time: 6-7-88/1520

Analyte: Hg
Data File: 8607
Inst./HGA Program #: 2/NA

6-14-88
pgs 1+2 Verified by EH McClendon

Cup #	Sample ID	Dilution	Abs.	Comments
AZ	DI Blank		-0.000	✓
01	0.000		-0.000	✓
02	0.020		0.009	✓
03	0.050		0.027	✓
04	0.100		0.057	✓
05	0.250		0.133	✓
06	0.500-1		0.256	✓
07	0.750		0.408	✓
08	1.00		0.534	✓
09	0.500-MERA		0.284	✓ 101%
10	DI Blank		0.001	✓
11	09168		0.002	✓
12	09169		0.046	✓
13	09170		0.145	✓
14	09171		0.483	✓
15	09169		0.045	✓
16	09170		0.136	✓
17	0.500-1		0.256	✓ 0% Drift

Cup #	Sample ID	Dilution	Abs.	Comments
18	09171		0.461	✓
19	DI Blank		-0.001	✓
20	09172	25mL DI + 25mL Sx	0.162	✓
21	09172		0.281	✓
22	09173		0.003	✓
23	09174		-0.002	✓
24	09175		-0.002	✓
25	09176		0.110	✓
26	09177		0.027	✓
27	09178		0.193	✓
28	0.500-1		0.271	✓ +5.9% Drift
29 NP 6-7-88	DI Blank ~~09179~~		-0.001	✓
30	09179		0.007	✓
31	09180		-0.002	✓
32	09181		-0.001	✓
33	09182		0.082	✓
34	09183		0.173	✓
35	09184		0.003	✓

Linear Regression Data:

Correlation Coefficient = 0.9996634
Y-Intercept = -0.0005357
Slope = 0.5319385

Additional Comments:

2 of 2

Atomic Absorption Worksheet

Project Number: 8910L02-13
Analyst:
Date/Time: 6-7-88/

Analyte: Hg
Data File: 0607
Inst./HGA Program #: 2/NA

Cup #	Sample ID	Dilution	Abs.	Comments
AZ	09185		0.107	✓ 101%
01	09186		-0.002	✓
02	09187		0.234	✓ 110%
03	0.560-1		0.273	✓ +6.6% Drift
04	0.020		0.009	✓
05	0.020		0.009	✓
06	0.020		0.008	✓
07	0.020		0.008	✓
08				
09				
10				
11				
12				
13				
14				
15				
16				
17				

Cup #	Sample ID	Dilution	Abs.	Comments
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				

Linear Regression Data:

Correlation Coefficient = Ref. pg 1 of 2 NF 6-7-88
Y-Intercept =
Slope =

Additional Comments:

Project 8910C Part #2 Part LXVIII
Data Station 10 Output -HgCVAAS-
6-7-88
Ed McClendon 6-17-88
1357:40

```
BEGIN DATA FILE:  0607.DF

Begin Element - HG
  -0.000
  -0.000
   0.009
   0.027
   0.057
   0.133
   0.256
   0.408
   0.534
   0.284
   0.001
   0.002
   0.046
   0.145
   0.483
   0.045
   0.136
   0.256
   0.461
  -0.001
   0.162
   0.281
   0.003
  -0.002
  -0.002
   0.110
   0.027
   0.193
   0.271
  -0.001
   0.007
  -0.002
  -0.001
   0.082
   0.173
   0.003
   0.107
  -0.002
   0.234
   0.273
   0.009
   0.009
   0.008
   0.008
ɔ̇ɔ̇ɔ̇ɔ̇ɔ̇ɔ̇ɔ̇
```

Project 8910L Part #2 Part LXVII.
Sample Weighing Sheet - Hg CVAAS
6-7-88
E H McClendon 6-17-88

1357:40

```
                      Sample Weighing Sheet

Project:  8910L02    Lot(s):  NA
Digestion code(s):   NA

Balance:  Make/Type:  Mettler AE200
          Serial Number:  F15236
          Location:  344W

Weighed by:  E. MCCLENDON            Notebook Ref.:  NA
Date:  06/07/88 Time:  08:10
-----------------------------------
MRI Sample ID         Sample Wt. (g)
-----------------------------------
100.000G             100.0007
150.000 G            150.0009
151.000 G            151.0010

Comments:
```

Sample Weighing Sheet

Project: 8910L02 Lot(s): NA
Digestion code(s): 7470

Balance: Make/Type: Mettler AE200
Serial Number: F15236
Location: 344W

Weighed by: E. MCCLENDON Notebook Ref.: 1357:37
Date: 06/07/88 Time: 08:13

MRI Sample ID	Sample Wt. (g)
09168	5.0158
09169	5.0884
09170	5.8754
09171	5.5345
09172	1.0630
09173	5.6535
09174	5.3377
09175	5.2456
09176	5.1310
09177	5.0679
09178	5.2775
09179	5.7524
09180	5.5862
09181	5.1026
09182	5.6539
09183	5.4184
09184	5.9964
09185	5.1068
09186	5.7239
09187	1.1243

Comments:

Project 8910C Part #2
Part LXIX
Sample Weighing Sheet - Hg CVAAS
Reagents - 6-7-88
E H McClendon
6-17-88
1357:40

Sample Weighing Sheet

Project: 8910L02 Lot(s): NA
Digestion code(s): 7470

Balance: Make/Type: Mettler AE200
Serial Number: F15236
Location: 344W

Weighed by: E. MCCLENDON Notebook Ref.:
Date: 06/06/88 Time: 12:46

MRI Sample ID	Sample Wt. (g)
KMNO4 648340	50.0139
K2S208 444704	25.7057
~~SNCL2 A04701~~	~~50.2095~~
SNCL2 A04701	50.1012
NACL 653719	60.9845
HYD SO4 A15700	61.2178

had to remake - spilled

HCl Lot A36053 Baker Instra Analyzed

Comments:

Project 89106 Part#2 Part LXX
Atomic Absorption Data
Reporting Sheet - Hg CVAA - 5-20-88
EdMcClendon 6-17-88
1357:40

ATOMIC ABSORPTION DATA REPORTING SHEET:

THE PERKIN - ELMER SYSTEM INCLUDES:

5000 ATOMIC ABSORPTION SPECTROPHOTOMETER
ZEEMAN 5000 GFAA ASSEMBLY
HGA 500 PROGRAMMER
AS 40 AUTO SAMPLER

ATOMIC SPECTROSCOPY DATA SYSTEM 10
PR-100 PRINTER
EDL POWER SUPPLY

PROJECT NUMBER: 8910o0213
LOT: Not Appl.
DATA FILE: 520A
I.D. / WEIGHT FILE: Not Appl
ANALYST: M Green / EMcClendon
DATE: 5-20-88
ELEMENT: Hg
SAMPLE MATRIX: 10% HNO$_3$/0.5M K$_2$Br$_3$

INSTRUMENTAL PARAMETERS FOR THE 5000 ATOMIC ABSORPTION SPECTROPHOTOMETER:

TIME (sec.): 30
ENERGY: 68
LAMP SOURCE: EDL
HCL CURRENT (ma): ____
EDL POWER (w): 8
WAVELENGTH (nm): 254.0

SLIT: H ____ L ✓
SLIT (nm): 0.7
INST. PROGRAM #: 2

MODE: ABSORBANCE ✓
CONCENTRATION ____
EMISSION ____

AA ✓
AA - BG ____
BG ____
ZAA ____

SIGNAL: CONTINUOUS ____
HOLD ____
PEAK HEIGHT ✓
PEAK AREA ____

RECORD DUPLICATES ✓
RECORD ABSORBANCE ✓
RECORD AVERAGE ____
COEFF. OF VARIATION ____

Volume Sn Cl$_2$ delivered in 12s 6.0mL

PARAMETERS FOR THE ZEEMAN 5000 - HGA 500 PROGRAMMER WITH AS 40 AUTO SAMPLER:

SAMPLE INJECTION VOLUME (mcL): ____
MATRIX MODIFIER: ____
MATRIX MODIFIER INJECTION VOLUME (mcL): ____

PURGE GAS ATMOSPHERE: ____
TUBE: PYROLYTIC ____
NON-PYROLYTIC ____
PLATFORM Y ____ N ____

HGA PROGRAM #: ____

CYCLE	RAMP TIME (sec.)	HOLD TIME (sec.)	TEMPERATURE (C)	FLOW RATE (mL/min.)
STEP 1				
STEP 2				
STEP 3				
STEP 4				
STEP 5				
STEP 6				

Not applicable
EDM 5-20-88

ADDITIONAL COMMENTS:

5311-AA-002

Project 8910C Part #2 Part LXXI
Sample Raw Data - Hg CVAAS · 5-20-88
ELM McClendon 6-17-88
1357:40

Atomic Absorption Worksheet

Project Number: 8910C0213
Analyst: ELM McClendon/M Greene
Date/Time: 5-20-88

Analyte: Hg
Data File: 520A
Inst./HGA Program #: 3/Not applicable
Verified by ELM McClendon 6-17-88

Cup #	Sample ID	Dilution	Abs.	Comments
AZ	DI H_2O		0.001 0.000	✓ ✓
01	DI H_2O		0.002	✓
02	DI H_2O		0.001 0.000	✓ Auto zero
03	DI H_2O		0.002	✓
04	0.000 µg		0.002	✓
05	0.020 µg		0.011 ~~0.011~~	ELM 5-20-88
06	0.050 µg		0.027	✓
07	0.100 µg		0.055	✓
08	0.250 µg		0.140	✓
09	0.500 µg		0.259	✓
10	0.750 µg		0.320	✓
11	1.00 µg		0.516	~~do not use~~ ELM 5-20-88
12	DI H_2O		0.012	✓
13	DI H_2O		0.003	✓
14	0.500 µg MRIWA		0.269	✓
15	DI H_2O		0.006	✓
16	Blank 2-24		0.002	✓
17	04379		-0.000	✓

Cup #	Sample ID	Dilution	Abs.	Comments
18	04379dup		-0.001	✓
19	04379spk		02ER	✓ overrange
20	DI H_2O		02ER	✓ *
21	DI H_2O		02ER	✓ *
22	DI H_2O		1.354	✓ *
23	DI H_2O		0.619	✓ *
24	DI H_2O		0.313	✓ *
25	DI H_2O		0.158	✓ *
26	DI H_2O		0.109	✓ *
27	DI H_2O		0.072	✓ *
28	DI H_2O		0.047	✓ *
29	DI H_2O		0.037	✓ *
30	DI H_2O		0.025	✓ *
31	DI H_2O		0.022	✓ *
32	DI H_2O		0.019	✓ *
33	spk 04379	0.25 mL + 50 mL H_2O	0.639	✓
34	DI H_2O		0.023	✓
35		0.1 mL + 50 mL H_2O	0.275	✓
	0.500 µg		0.252	✓
	DI H_2O		0.022	✓
	0.020 µg		0.019	✓
	0.020 µg		0.015	✓
	0.020 µg		0.014	✓
	0.020 µg		0.015	✓

Linear Regression Data:

Correlation Coefficient = 0.9928330 w/1.00
Y-Intercept =
Slope =

Additional Comments: * Carry over blanks to flush system 5-20-88 ELM

```
BEGIN DATA FILE:  520A.DF

Begin Element - HG
   0.001
   0.000 AZ
   0.002
   0.001
   0.000 AZ
   0.002
   0.002
   0.011
   0.027
   0.055
   0.140
   0.259
   0.320
   0.516
   0.012
   0.003
   0.269
   0.006
   0.002
   0.000
  -0.001
      02 ER
      02 ER
      02 ER
   1.354
   0.619
   0.313
   0.158
   0.109
   0.072
   0.047
   0.037
   0.025
   0.022
   0.019


   0.639
   0.023
   0.275
   0.252
   0.022
   0.019
   0.015
   0.014
   0.015
```

Project 8910C Part #2 Part 2XXII
Data Station 10 Output - Hg
CVAAS - 5-20-88
E H McClendon 6-17-88
1357:40

Project 8910C Out #2 Part LXXIII
Sample Weighing Sheet - Hg CVAAS.
5-20-88
EHMcClendon 6-17-88
B57:40

Sample Weighing Sheet

Project: 8910021 Lot(s): N/A
Digestion code(s): 7470

Balance: Make/Type: Mettler AE200
Serial Number: F15236
Location: 344W

Weighed by: M GREENE Notebook Ref.: N/A
Date: 05/19/88 Time: 11:07

MRI Sample ID	Sample Wt. (g)
BLK 7-24	5.7726
04379	5.4171
04379 DUP	5.2832
04379 SPIKE	5.3116

Preparation had to be redone. ~~spilled~~ EHM 5-20-88 preparation problems. EHM 5-20-88

Comments:

Sample Weighing Sheet

Project: 8910021 Lot(s): 04379 HG
Digestion code(s): 7470

Balance: Make/Type: Mettler AE200
Serial Number: F15236
Location: 344W

Weighed by: M GREENE Notebook Ref.:
Date: 05/20/88 Time: 10:03

MRI Sample ID	Sample Wt. (g)
04379	5.2699
04379 DUP	5.6211
04379 SPIKE	5.7842
BKL 2-24	5.6745

use these weights EHM 5-20-88

Comments:

Project 89102 Audit #2
Part LXXIV Sample Weighing
Sheet - HgCVAAS Reagents
5-20-88
E. S. McClendon 6-17-88
1357:40

MG
5/19/88

Sample Weighing Sheet

Project: 8910 02 Lot(s): N/A
Digestion code(s): 7470

Balance: Make/Type: Mettler AE200
Serial Number: F15236
Location: 344W

Weighed by: M GREENE Notebook Ref.: N/A
Date: 05/19/88 Time: 09:11

MRI Sample ID	Sample Wt. (g)
SNCL2	50.5162
NACL	60.1191
HYDR-SULF	60.8208
KMNO4	50.8078
K2S208	25.4770

Comments:

Project 89106 Part LXVII
MRI Laboratory Generated Inventory 1 of 2
TAP 6-20-88
Notebook Ref: 1357:40

Project No: 891060213

Sample Type:
MB method blank
S sample
D duplicate
MSL metals spike low
MSLD metals spike low duplicat
MSH metals spike high
MSHD metals spike high duplica
MS = metals spike
ELM 5-26-88

MRI LABORATORY-GENERATED SAMPLE INVENTORY

Sample Identification	Sample Type (MB; D, MS for Sample No.; Std. Conc.)	Procedure (T.C., L, F)	Initials	Date
MRI SAMPLE 09168	Method Blank	TC	ELM	5-26-88
MRI SAMPLE 09169	1033 (04260) S			
MRI SAMPLE 09170	1033 (04261) BD			
MRI SAMPLE 09171	1036 (04262) S			
MRI SAMPLE 09172	1036 MS			
MRI SAMPLE 09173	1042 (04264) S	ELM 5-26-88	ELM 5-26-88	ELM 5-26-88
MRI SAMPLE 09174	1046 (04265) S			
MRI SAMPLE 09175	1046 (04266) BD			
MRI SAMPLE 09176	1046 MS			
MRI SAMPLE 09177	2033 (04268) S			

Sample Type:
- MB method blank
- S sample
- D duplicate
- MSL metals spike low
- MSLD metals spike low duplicat
- MSH metals spike high
- MSHD metals spike high duplica

Project No: 89ICL0213

MRI LABORATORY-GENERATED SAMPLE INVENTORY

Sample Identification	Sample Type (MB; D, MS for Sample No.; Std. Conc.)	Procedure (T.C., L, F)	Initials	Date
MRI SAMPLE 09178	2036 (04269) S	TC	Edm	5-26-88
MRI SAMPLE 09179	2042 (04270) S			
MRI SAMPLE 09180	2046 (04271) S			
MRI SAMPLE 09181	NBS 1633a (04272) S			Edm 5-26-88
MRI SAMPLE 09182	3033 (04273) S	Edm 5-26-88	Edm 5-26-88	
MRI SAMPLE 09183	~~30~~ Edm 5-26-88 3036 (04274) S			
MRI SAMPLE 09184	3046 (04275) S			
MRI SAMPLE 09185	Reference Spike (Low) S			
MRI SAMPLE 09186	Method Blank #2 MB	TC	Edm	5-27-88
MRI SAMPLE 09187	Reference Spike (High)	Edm 5-27-88	Edm 5-27-88	Edm 5-27-88

Project 8910C Part #2 Part LXXVI
Photocopies of Notebook ETSRC (2 pages)
LE MRI Project No. 8910-L0213
ESM McClendon 6-17-88

ETSRC
Project No. 8051711
Book No. 241

5/31/88 TO
6/1/88

om Page No. 5/31/88

1357:40

ETSRC ID	ORIGINAL SAMPLE	FINAL SAMPLE	WEIGHT	BOMB	COMMENTS (SAMPLE DESCRIP
8051711	Blank I	09168	—	1	
1713	04260	09169	0.507	2	inhomogeneous ash
1714	04261	09170	0.501	3	" "
1715	04262	09171	0.506	4	" "
1715S	04262	09172	0.507	5	" "
1716	04264	09173	0.875	6	" ", very coarse, with liquid
1717	04265	09174	0.571	7	white lime in solution (lime sl
1718	04266	09175	0.586	8	"
1718S	04266	09176	0.517	9	"
1719	04268	09177	0.508	10	inhomogeneous ash
~~1720~~ NO ID CRN	Ref spk 1 CRN ~~04269~~ NO ID	NO ID	—	11	
1727	Ref. Spk2	09185	—	12	

Ref. spk 1 and 09172 were spiked with 1.0 ml soln' A and 1.5 ml soln' B.

Ref. spk 2 (09185) and 09176 were spiked with 0.098 ml soln' A.

Digestion procedure:

TIME	POWER	LOAD	COMMENTS
60 mins. in increments of 5 mins.	100% @600W	12	The samples were cooled every 5 mins for 5 mins.

To Page No.

Witnessed & Understood by

Date

Invented by

Recorded by

Date 6/1/88 9-10 clean 10:00 - 5:00

Thes

ETSRC
Project No. 8051711

LE MRI Project No 8910 - L0213 Book No. 241

m Page No. 65 5/31/88

Carol

TSRC ID	ORIGINAL SAMPLE	FINAL SAMPLE	WEIGHT	BOMB	
8051712	~~04269~~ Blank	09186		B	
1720	04269	09178	0.504	14	inhomogeneous ash
1721	04270	09179	0.502	15	"
1722	04271	09180	0.568	16	lime slurry
1723	04272	09181	0.509	17	inhomogeneous ash
1724	04273	09182	0.508	18	"
1725	04274	09183	0.508	19	"
1726	04275	09184	0.657	20	lime slurry

TIME	POWER	LOAD
40 mins. in increments of 5 mins.	100% (600 w)	8

To Page No.____

Witnessed & Understood by me.	Date	Invented by	Date	
		Recorded by	6/1/88 9:30 - 1:15	3 3/4 +

Project 8910L Part LXXVII
Photocopies of MRI Notebook
MA 6-20-88

MRI Project No.: 8910-0213 Performed by (name/date): M. Greene 5/19/88
Title/Purpose: Merc Hg analysis

Continued from: Start Continued to: ~~End~~ 29 MG 5/19/88 Entered by: M Greene Verified by:
Witnessed by: Reviewed by: Validated by:
Witnessed by:
(signature/date) (initials/date) (initials/date)

Today I reprepped Sample# 04379 & Blank 7-24 for Hg analysis. The following Samples were generated.
MRI 6A - Check Sample
Blank 7-24
04379
04379 dup
04379 spk -> (1.25 ml of 1000 ug/l Hg stock)

The following Working stds were made as follows.
A working standard solution was prepared by pipetting 0.10 ml of Hg std (Baker lot A29605 1000 ug/ml) into a 100 ml vol. Flask containing approx. 50 mls of milli Q H2O & 0.150 ml HNO3 (Baker lot# A51041). This solution was diluted up to correct vol with milli Q H2O & mixed thoroughly.
A check std was made (6A MRI) by pipetting 1.0 ml of MRI-6A info as follows.

Maurene Greene 5/19/88

MG 5/19/88

MRI6A Manufacturer: Spex Industries, Inc.; Lot 1-26-TH; Matrix 20 % HCl; Expiration Date 5/89; Contains 100 mcg/mL each Al, As, B, Ba, Hg, K, Mg, Mn, Mo, Na, Ni, Sb, Sn, Ti, V, Sr and Li

MAURENE GREENE 5/19/88

into a 100 ml Vol. Flask containg ~50 mls of milli Q H2O & 0.150 ml of HNO3 (conc/same lot#). the solution was diluted to volume with milli Q H2O & mixed thoroughly. The working solutions were made up (Check data printout in project file.) Samples were weighed into tared 250 ml Erlenmeyer flasks. The working solution was used to prepare the following calibration standards. This info is on the next page.

MG
5/19/88

MRI Project No.: 8910-0213 **Performed by (name/date):** M Greene 5/19/88

Title/Purpose: Merc Ag Analyses

Continued from: pg 28 **Continued to:** 1357: 41 **Entered by:** M Greene **Verified by:**

Witnessed by: **Reviewed by:** [illegible] 6-17-88 **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

Volume (ul) of 10 ug/ml Ag Solution added	total (Ag) per 250ml Final sol.	Hg (ug) per 50ml Aliquot
0.000	0.000	0.000
0.~~020~~100	0.100	0.020
0.250	0.250	0.050
0.500	0.500	0.100
1.25	1.25	0.250
3.75	3.75	0.750
5.00	5.00	1.000

the working std solution was transferred into the app. 250 ml elenmyer Flask using Eppendorf pippetts. milliQ H_2O was used to bring total wt of samples to 5gs if needed. These stds & samples were dosed with 5 mls of H_2SO_4 (Lot# A34038 Baker) & 2.5 ml of HNO_3 (same lot#) 20 mls of $KMnO_4$ was added to each Sample & Standard. After waiting 15 mins and observing no loss of $KMnO_4$ purple color, 8 mls of the $K_2S_2O_8$ soln. was added to every flask. The flasks were placed in a hot H_2O bath for 2 hrs. During these 2 hrs. the flasks were vented & swirled occasionally. After the 2 hrs were up the samples & stds were allowed to cool and were then dosed with 6 mls of Sodium Chloride Hydroxylamine Sulfate. After observing that all solutions became clear they were transferred to 250 ml vol. flasks & diluted up to volume with D.I. H_2O

KCO
5/19/88

MRI Project No.: 8910C0213 **Performed by (name/date):** E.L. McClendon 5-26-88
Title/Purpose: Spiking Solution Preparation - Reprepped Ashes

Continued from: Start **Continued to:** End **Entered by:** ELM **Verified by:**
Witnessed by: **Reviewed by:** M 6-20-88 **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

The following Standard Analytical Reference Materials (SARMs) were used to prepare spiking solutions for sample preparation:

ELM 5-26-88

5-26-88 ELM MRI5 Manufacturer: Spex Industries, Inc.; Lot 1-25-TH; Matrix 10 % HNO3; Expiration Date 5/89; Contains 100 mcg/mL each Ag, Be, Ca, Cd, Co, Cr, Cu, Fe, P, Pb, Se, Tl, Y and Zn. ELM 5-26-88

ELM 5-26-88

1000 µg/mL As: Manufacturer: Spex Industries, Inc.; Lot 1-19-KV; Matrix 2% HNO_3; Expiration Date 1-89; Contains 1000 µg/mL As.

1000 µg/mL Hg: Manufacturer: J.T. Baker Chemical Co; Lot A29605; Matrix 1.0 M HNO_3; Expiration date 8-88; Contains 1006 µg/mL Hg.

1000 µg/mL Pb: Manufacturer: Spex Industries, Inc; Lot 1-12-LP; Matrix 2% HNO_3; Expiration Date 1-89; Contains 1000 µg/mL Pb.

Spiking solutions were prepared in 10% (v/v) HNO_3 (Baker Instra Analyzed Lot A51040).

Spiking Solution A: 12.5 mL MRI5 plus 1.25 mL 1000 µg/mL As plus 2.50 mL 1000 µg/mL Hg plus 2.50 mL 1000 µg/mL Pb diluted to 25 mL.

Spiking solution B consists strictly of the 1000 µg/mL Pb solution.

The spike for sample 04266 was to consist of 0.100 mL spiking solution A; while for sample 04262 it was to be 1 mL of spiking solution A plus 1.5 mL of spiking solution B.

Samples resubmitted to ETSRC for digestion.

ELM 5-26-88

MRI Project No.: 8910L02I3 **Performed by (name/date):** ESMcCandless 6-6-88
Title/Purpose: Reanalyses of Ash/Lime Slurry Samples

Continued from: Start **Continued to:** 1357:36 **Entered by:** ESM/6-6-88 **Verified by:**
Witnessed by: **Reviewed by:** MP/6-20-88 **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

A 0.5M H_3BO_3/10% (V/V) HNO_3 solution was prepared as follows: 15.4554 g H_3BO_3 (Fisher ACS, Lot 755927) plus 50 mL conc HNO_3 (Baker InstraAnalyzed Lot A51040) were diluted to 500 mL with Milli Q H_2O.

A 10% (V/V) HNO_3 solution was prepared by diluting 100 mL conc HNO_3 (Baker InstraAnalyzed Lot A51040) to 1 L with Milli Q H_2O.

The following Standard Analytical Reference Materials (SARMs) will be used for all analyses:

ESM 6-6-88

MRI1A	Manufacturer: Inorganic Ventures, Inc.; Lot C10WG; Matrix 10 % HNO3; Expiration Date 11-1-88; Contains 100 mcg/mL each Ag, Be, Ca, Cd, Co, Cr, Cu, Fe, P, Pb, Se, Tl, Y and Zn.
MRI2A	Manufacturer: Inorganic Ventures, Inc.; Lot C10WG; Matrix 10 % HCl; Expiration Date 11-1-88; Contains 100 mcg/mL each Al, As, B, Hg, K, Mg, Mn, Mo, Na, Ni, Sb, Sn, Ti, Ba, V, Sr, and Li.
MRI5	Manufacturer: Spex Industries, Inc.; Lot 1-25-TH; Matrix 10 % HNO3; Expiration Date 5/89; Contains 100 mcg/mL each Ag, Be, Ca, Cd, Co, Cr, Cu, Fe, P, Pb, Se, Tl, Y and Zn.
MRI6A	Manufacturer: Spex Industries, Inc.; Lot 1-26-TH; Matrix 20 % HCl; Expiration Date 5/89; Contains 100 mcg/mL each Al, As, B, Ba, Hg, K, Mg, Mn, Mo, Na, Ni, Sb, Sn, Ti, V, Sr and Li.
MRI7	Manufacturer: Spex Industries, Inc.; Lot 1-27-TH; Matrix 10% HNO3; Expiration Date 5/89; Contains 1000 mcg/mL each Al, Ca, Fe, K, P and Na.

ESM 6-6-88

ESM 6-6-88

ESM 6-6-88

As GFAA Analysis Standard Preparation and analysis:
500 µg/L MRI6A: 0.85 mL MRI6A stock diluted to 50 mL with 10% HNO_3.
100 µg/L MRI2A: 50 µl MRI2A stock diluted to 50 mL with 10% HNO_3.

The following standards for analysis were prepared in disposable beakers using Eppendorf pipets 12, 15 + 20:

250 µg/L (MRI6A): 2.5 mL 500 µg/L MRI6A plus 0.5 mL 0.5M H_3BO_3/10% HNO_3 plus 2 mL 10% HNO_3.

100 µg/L (MRI6A): 2 mL 500 µg/L MRI6A plus 1 mL 0.5M H_3BO_3/10% HNO_3 plus 7 mL 10% HNO_3.

50 µg/L (MRI6A): 0.5 mL 500 µg/L MRI6A plus 0.5 mL 0.5M H_3BO_3/10% HNO_3

MRI Project No.: 8910L0213 **Performed by (name/date):** ELM McClendon 6-6-88
Title/Purpose: Reanalysis of Ash/Lime Slurry Samples

Continued from: 1357:35 **Continued to:** 1357:37 **Entered by:** ELM 6-6-88 **Verified by:**
Witnessed by:
Reviewed by: 6-20-88 **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

plus 4 mL 10% HNO_3.

25 µg/L (MRI6A): 0.5 mL 250 µg/L (MRI6A) plus 0.5 mL 0.5 M H_3BO_3/10% HNO_3 plus 4 mL 10% HNO_3.

10 µg/L (MRI6A): 0.5 mL 100 µg/L (MRI6A) plus 0.5 mL 0.5 M H_3BO_3/10% HNO_3 plus 4 mL 10% HNO_3.

5 µg/L (MRI6A): ELM ~~[illegible]~~ 1.0 mL 50 µg/L (MRI6A) plus 1 mL 0.5 M H_3BO_3/10% HNO_3 plus 8 mL 10% HNO_3.

0 µg/L : 1 mL 0.5 M H_3BO_3/10% HNO_3 plus 9 mL 10% HNO_3.

NBS 1643b or 100 µg/L MRI2A dilution: 0.25 mL 0.5 M H_3BO_3/10% HNO_3 + 1 mL 10% HNO_3 + 1.25 mL [illegible].

The Perkin-Elmer Zeeman 5000 was allowed to warm up approximately 2 hours. All samples required 1/10 dilution due to high salt content. Sample dilutions carried out in disposable beakers with Eppendorf pipets 15 + 20 by adding 2.25 mL of 10% HNO_3 to 0.25 mL sample. The instrument and furnace parameters, along with the description of the matrix modifier used, is recorded on the appropriate sheets in the data packet.

Pb GFAA Analysis Standard Preparation and analysis:

500 µg/L MRI5: 0.25 mL MRI5 stock diluted to 50 mL with 10% HNO_3.

100 µg/L MRI1A: 50 µL MRI1A stock diluted to 50 mL with 10% HNO_3.

The following standards were prepared for analysis in disposable beakers with Eppendorf pipet Nos. 12, 15 + 20.

100 µg/L (MRI5): 1 mL 500 µg/L MRI5 plus 0.5 mL 0.5 M H_3BO_3/10% HNO_3 plus 3.5 mL 10% HNO_3

50 µg/L (MRI5): 1 mL 500 µg/L MRI5 plus 1 mL 0.5 M H_3BO_3/10% HNO_3 plus 8 mL 10% HNO_3

25 µg/L (MRI5): 0.25 mL 500 µg/L MRI5 plus 0.5 mL 0.5 M H_3BO_3/10% HNO_3 plus ~~3~~ ~~4.75~~ ELM 6-6-88 4.25 mL 10% HNO_3.

10 µg/L (MRI5): 0.5 mL 100 µg/L (MRI5) plus 0.5 mL 0.5 M H_3BO_3/10% HNO_3 plus 4 mL 10% HNO_3.

5 µg/L (MRI5): 1 mL 50 µg/L (MRI5) plus 1 mL 0.5 M H_3BO_3/10% HNO_3 plus 8 mL ~~H_2O~~ ELM 6-6-88 10% HNO_3

0 µg/L : 1 mL 0.5 M H_3BO_3/10% HNO_3 plus 9 mL 10% HNO_3.

MRI Project No.: 8910L021.3 **Performed by (name/date):** ESM McClendon 6-6-88
Title/Purpose: Reanalysis of Ash/Lime Slurry Samples

Continued from: 1357:36 **Continued to:** 1357:38 **Entered by:** ESM 6-6-88 **Verified by:**
Witnessed by: **Reviewed by:** MF/6-20-88 **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

NBS 1643b and 100 ug/L MRI 1A dilutions : 0.25 mL 0.5 M H_3BO_3/10% HNO_3 plus 1 mL 10% HNO_3 plus 1.25 mL Sx.

The Perkin Elmer Zeeman 5000 was allowed to warm up approximately ½ hour with the Pb HCL; the rest of the unit was already warm from the As GFAA analysis. Instrument and furnace parameters, along with description of the matrix modifier used, is recorded on appropriate sheets in the data packet. Sample dilutions were performed as during the As GFAA analysis.

Preparation of Stock Solutions for Hg CVAAS (Method 7470):

$KMnO_4$ solution: 50.0139 g $KMnO_4$ (Baker ~~In~~ ESM 6-6-88 Analyzed Lot 648340) was diluted to 1 L with DI H_2O.

$K_2S_2O_8$ solution : 25.7057 g $K_2S_2O_8$ (Baker Analyzed Lot 444704) was diluted to 500 mL with DI H_2O.

$SnCl_2$ solution : 50.1012 g $SnCl_2$ (Baker Analyzed Lot ~~A4~~ ESM 6-6-88 A04701) plus 250 mL conc. HCl (Baker Instra Analyzed Lot A36053) was diluted to ~~50~~ 500 ESM 6-6-88 mL with Di H_2O.

NaCl/hydroxylamine sulfate solution : 60.9845 g NaCl (Baker Analyzed Lot 653719) plus 61.2178 g hydroxyl amine sulfate (Baker Analyzed Lot A15700) were diluted to 500 mL with Di H_2O.

End of Work 6-6-88

Date of Work 6-7-88 by ESM Recorded 6-14-88 by ESM

Weighed out samples for CVAAS. Using Method 7470 for preparation & analysis for CVAAS. Used 20 mL $KMnO_4$ solution as had a 10 mL dispenser. All other volumes as described in Method 7470. Prepared samples through point where they spend 2 hr in water bath. At this point turned digestion over to N. Friedrich. (see 1357:39 for further details) ESM 6-14-88

ICAP Sample Analysis:

The following standards were prepared for analyses. All standards were diluted with the stock 0.5 M H_3BO_3/10% HNO_3 solution.

MRI Project No.: 8910a0213 **Performed by (name/date):** ESMcClendon 6-7-88
Title/Purpose: Reanalysis of Ash/Lime Slurry Samples.

Continued from: 1357:37 **Continued to:** 1357:39 **Entered by:** ESM 14-88 **Verified by:**
Witnessed by: **Reviewed by:** 6/20/88 **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

5 μg/mL MRI5: 2.5mL MRI5 stock diluted to 50mL.
10 μg/mL MRI5: 2.5mL MRI5 stock diluted to 25mL.
5 μg/mL MRI6A: 2.5mL MRI6A stock diluted to 50mL.
10 μg/mL MRI6A: 2.5mL MRI6A stock diluted to 25mL.
75 μg/mL MRI7: 3.75mL MRI7 stock diluted to 50mL.
~~9~~ ESM 6-14-88
150 μg/mL MRI7: 7.50mL MRI7 stock diluted to 50mL
1 μg/mL MRI1A: 0.25mL MRI1A stock diluted to 25mL.
1 μg/mL MRI2A: 0.25mL MRI2A stock diluted to 25mL.
Interferent check standard: 2.5mL MRI3 stock plus 0.25mL ~~MRI5A~~ MRI5 ESM 6-14-88 stock plus 0.25mL ~~MRI2A~~ MRI6A ESM 6-14-88 stock diluted to 25mL.

The Jarrell-Ash Model 1155A was allowed to warm up approximately 2 hours and then was standardized according to the manufacturer's instructions. All ash samples, along with the high reference spike (09187) were diluted 1/10 with 0.5M H_3BO_3/10% HNO_3. The analysis proceeded smoothly, except that the elements in MRI_5 (Cd, Cr, Pb) needed restandardization before samples were run.

CVAAS prep (con't)

The following standards were prepared for this analysis:
1000 μg/L MRI2A: ~~0.5mL~~ 0.5mL ESM 6-14-88 MRI2A stock was diluted to 50mL with 10% (v/v) HNO_3 (Baker Instra Analyzed Lot AS1040).
1000 μg/L MRI6A: 0.5mL MRI6A stock diluted to 50mL with 10% HNO_3.

The following standards were prepared by pipetting the following amounts of the respective standard into the 250mL Erlenmeyer flasks used for digestion: ~~of all samples~~ ESM 6-14-88

ESM 6-14-88

MRI Project No.: 891060213 **Performed by (name/date):** EDM McClendon 6-7-88
Title/Purpose: Reanalysis of Ash/Lime Slurry Samples

Continued from: 1357:38 **Continued to:** 1357:40 **Entered by:** EDM 6-14-88 **Verified by:**
Witnessed by: **Reviewed by:** NF 6-20-88 **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

Using the 1000µg/L MRZ6A solution:

Volume (mL) of standard added	Total (µg) per 250mL final Volume	µg Hg per 50mL Analysis Aliquot
0.000	0.000	0.000
0.100	0.100	0.020
0.250	0.250	0.050
0.500	0.500	0.100
1.25	1.25	0.250
2.50	2.50	0.500
3.75	3.75	0.750
5.00	5.00	1.00

2-0.500 µg standards were prepared for the calibration curve. Using the 1000µg/L MRZ2A solution, a standard was prepared by pipetting 2.50 mL of this solution into an Erlenmeyer for digestion. All standards had 10 mL Milli Q H_2O added to them to increase the volume to approximate the samples.

End of Work 6-7-88 by EDM

Date of Work: 6-7-88 Performed by: NF Entered by: NF/6-14-88

Mercury CVAAS Prep (cont.) and Analysis:

On 6-7-88 the digestion started by E McClendon on 1357:37 ~~were~~ NF 6-14-88 was continued by N. Friederich. Following the 2h digestion in the water bath, the samples : standards were removed from the bath and allowed to cool. 6 mL of the sodium chloride hydroxylamine sulfate soln (1357:37 lines 19-22) was added to each. All digests were diluted to a final 250 mL Volume with deionized water.

The Perkin-Elmer 5000 AAS and MHS-10 were ~~st~~ NF 6-14-88 set up and allowed to equilibrate approximately 2h. The $SnCl_2$ Solution (1357:37 lines 16-18) was transfered to the reservoir located on the MHS-10. The reductant volume was calibrated to deliver 6.1 mL $SnCl_2$ Soln. in 12 S.

The analysis proceeded smoothly.

NF 6-14-88

MRI Project No.: 8910L0213 **Performed by (name/date):** EHMcClendon 6-17-88

Title/Purpose: Reanalysis of Ash/Lime Slurry Samples

Continued from: 1357:39 **Continued to:** End **Entered by:** EHM 6-17-88 **Verified by:**

Witnessed by: **Reviewed by:** M 6-20-88 **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

The report contains the following (additional) parts:

Part No.	Description
LV	ICP-AES Data Reporting Sheet 6-7-88
LVI	Control Table Editor Output 6-7-88
LVII	DEC Command Files Used - 6-7-88
LVIII	ICAP Sample Raw Data - 6-7-88
LIX	Atomic Absorption Data Reporting Sheet - As GFAA - 6-6-88
LX	Sample Raw Data - As GFAA - 6-6-88
LXI	Data Station 10 Output - 6-6-88 - As GFAA
LXII	Atomic Absorption Data Reporting Sheet - Pb GFAA - 6-6-88
LXIII	Sample Raw Data - Pb GFAA - 6-6-88
LXIV	Data Station 10 Output - Pb GFAA - 6-6-88
LXV	Atomic Absorption Data Reporting Sheet - Hg CVAA - 6-7-88
LXVI	Sample Raw Data - Hg CVAA - 6-7-88
LXVII	Data Station 10 Output - Hg CVAA - 6-7-88
LXVIII	Sample Weighing Sheet - Hg CVAA - 6-7-88
EHM 6-17-88 ~~LXV~~ LXIX	Sample Weighing Sheet - Hg CVAA Reagents - 6-7-88
LXX	Atomic Absorption Data Reporting Sheet - HgCVAA - 5-20-88
LXXI	Sample Raw Data - Hg CVAA - 5-20-88
LXXII	Data Station 10 Output - 5-20-88
LXXIII	Sample Weighing Sheet - HgCVAA - 5-20-88
LXXIV	Sample Weighing Sheet - Hg CVAA Reagents 5-20-88
LXXV	Photocopies of MRI Laboratory Generated Inventory Sheets #2
LXXVI	Photocopies of Notebook ETSRC (2 pages)
LXXVII	Photocopies of Notebook (MRI) 1357: 28-29, 32, 35-41

EHM 6-17-88

MRI Project No.: 8910 L0213 **Performed by (name/date):** E.S. McClendon 5-20-88
Title/Purpose: MERC Hg Analysis - 04379
Continued from: 1350:29 **Continued to:** End
Entered by: ESM/6-17-88 **Verified by:**
Witnessed by:
Reviewed by: TF/6-20-88 **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

On 5-20-88, the samples prepared on 1357:28-29 were analyzed on the Perkin Elmer 5000, after it was allowed to equilibrate approximately 2hr. The instrument parameters are recorded on the appropriate data sheets in the data packet. Analysis proceeded smoothly until analysis of 04379 spk which created an overrange reading on the unit. Ran DI H_2O blanks until level returned to a reasonable (less than 0.030 A units) level. Diluted sample 04379 spk 1/500 and reran. Now "on scale" (get reading) but out of calibrated range. Ran 1/1000 dilution of 04379 spk. Appears, in retrospect, that this sample was accidentally spiked with the 1000 µg/mL Hg standard instead of the 1000 µg/L standard as the level is approximately 1000 times too high. Sample itself, however, did not show any Hg in either the sample or duplicate; therefore, the run was valid as the midpoint run after the 1/1000 dilution was within protocol for drift.

ESM 6-17-88

APPENDIX I

LABORATORY ANALYSIS - OTHER SAMPLES

HARRY W. GALBRAITH, PH.D
CHAIRMAN OF THE BOARD

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P.O. BOX 51610
KNOXVILLE, TN 37950-1610

2323 SYCAMORE DR.
KNOXVILLE, TN 37921-1750

Corrected Copy

Mr. Scott Klamm
Midwest Research Institute
425 Volker Boulevard
Kansas City, Missouri 64110

February 2, 1988

Received: January 5th

Dear Mr. Klamm:

Analysis of your compounds gave the following results:

Your #,	Our #,	% Carbon,	% Ash,
1037 Fabric Filter Ash	Y-2540	5.57 5.40	88.96 89.26
2037 Fabric Filter Ash	Y-2541	2.62	96.05
3037 Fabric Filter Ash	Y-2542	3.67	90.21
1034 Cyclone Ash	Y-2543	1.12 0.99	98.30 98.38
2034 Cyclone Ash	Y-2544	0.89	98.27
3034 Cyclone Ash	Y-2545	1.60	95.84
1043 Bottom Ash	Y-2546	1.58 1.03	74.48 75.86
2043 Bottom Ash	Y-2547	1.11	75.48

LETTER AND SHIPMENTS BY U.S. MAIL - P.O. BOX 51610, KNOXVILLE, TN 37950-1610. OTHER CARRIERS - 2323 SYCAMORE DR. KNOXVILLE, TN 37921-1750

ESTABLISHED 1950

Your #,	Our #,	% CaO,	% Solids,	Specific Gravity,
1071 Lime Slurry	Y-2548	11.76 11.91	20.60 20.65	1.131 1.130
2071 Lime Slurry	Y-2549	9.58	18.34	1.122
3071 Lime Slurry	Y-2550	12.30	22.11	1.145

The Carbons were determined by Galbraith Laboratories Method ME-6.

Samples were Ashed at 625°C.

Sincerely yours,

GALBRAITH LABORATORIES, INC.

Gail R. Hutchens
Exec. Vice-President

GRH:sc

Southern Research Institute 2000 Ninth Avenue South / P.O. Box 55305 / Birmingham, Alabama 35255-5305 / (205) 323-6592

January 28, 1988

Mr. George Scheil
Midwest Research Institute
425 Volker Boulevard
Kansas City, MO 64110

Re: Laboratory resistivity measurements of four ash samples;
MRI P.O. 94810; SRI Project 6506

Dear Mr. Scheil:

Attached are the results of laboratory resistivity measurements on the four ash samples sent to us. The sample identifications match the dates on the labels on the bottles (note that one of the bottles had no identifying label). The data were acquired according to IEEE Standard 548-1984, descending temperature method, in an atmosphere containing 14.8% water vapor by volume. However, we were able to apply the full 2000 volts specified in the Standard to these samples only in the range of 125 to 250°C because of their high conductivity. For the rest of the data points it was necessary to reduce the applied voltage to avoid ohmic heating of the sample.

As you can see from the graph, the unlabeled sample had the highest resistivity. The other three samples had comparable resistivities throughout most of the temperature range, with the 9DEC87 sample having significantly lower resistivity below about 160°C.

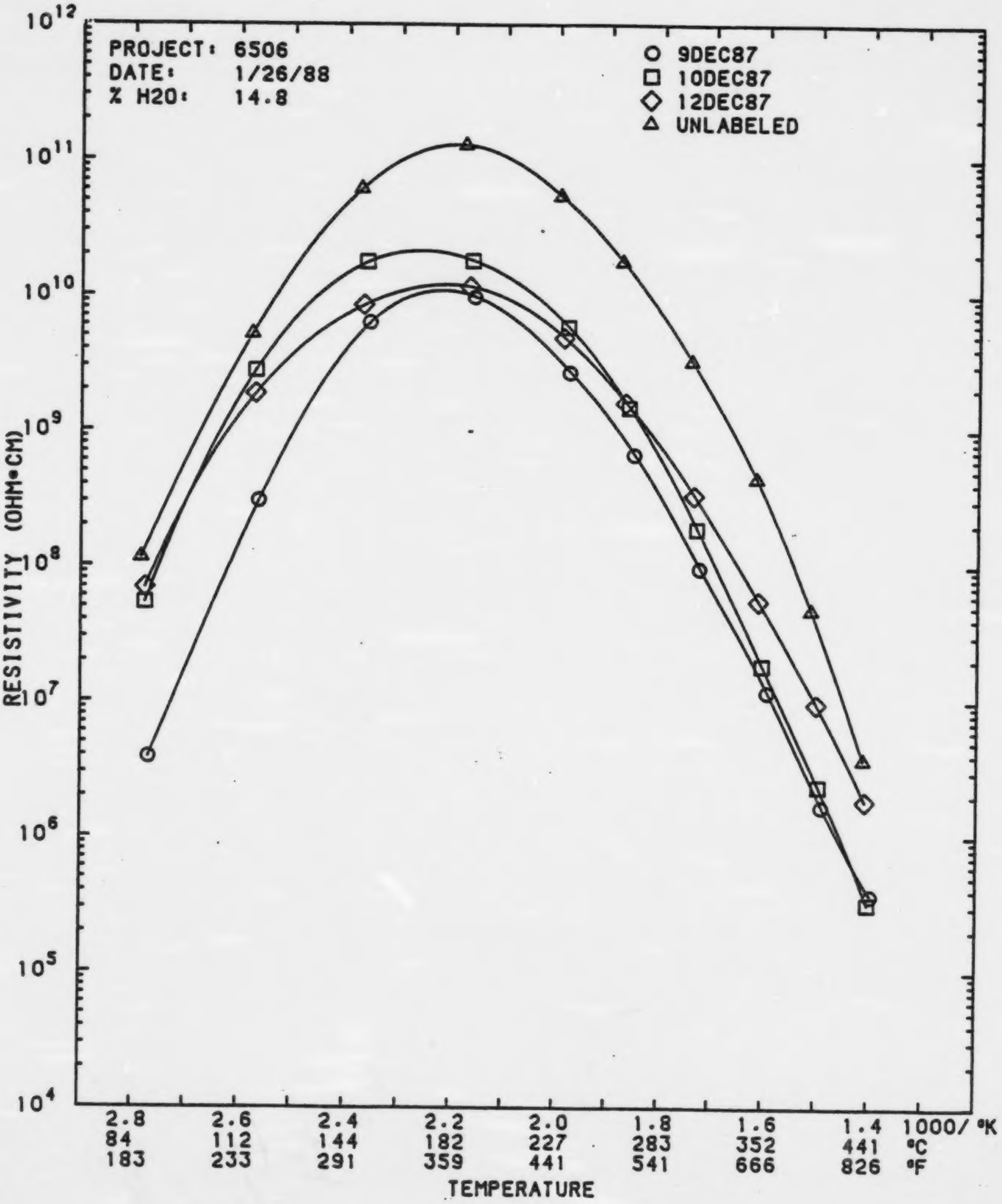
If you have any questions concerning the data or test procedures, please call.

Sincerely,

Ronald P. Young

Ronald P. Young, Ph.D.
Research Physicist

RPY/jp
Project 6506
SRI-EAS-88-097


PROJECT: 6506
DATE: 1/26/88
% H20: 14.8
○ 9DEC87
□ 10DEC87
◇ 12DEC87
△ UNLABELED
RESISTIVITY (OHM•CM)
10^{12}
10^{11}
10^{10}
10^{9}
10^{8}
10^{7}
10^{6}
10^{5}
10^{4}
2.8 2.6 2.4 2.2 2.0 1.8 1.6 1.4 1000/°K
84 112 144 182 227 283 352 441 °C
183 233 291 359 441 541 666 826 °F
TEMPERATURE

APPENDIX J

EQUIPMENT AND CALIBRATION DATA

TABLE J-1. SUMMARY OF EQUIPMENT USED DURING THE MAINE ENERGY RECOVERY CO. TEST PROGRAM, DECEMBER 9-12, 1987

Date	Run	Location[a]	Parameter[b]	Nozzle I.D.	Probe length (ft)	Stack T/C	Pyrometer I.D.	Pilot I.D.	Console[c] no.	Train[d] no.
12-9-87	1	Inlet	SV	N-2	8	96-1	9518	S-3	9	5
		Outlet	SV	N-3	6	72-1	9517	S-5	10	6
		Inlet	PM	N-12	8	6-2	9516	S-9	3	2
		Outlet	PM	N-32	6	6-1	9879	S-8	6	3
12-10-87	2	Inlet	SV	N-2	8	96-1	9518	S-3	9	5
		Outlet	SV	N-3	6	72-1	9517	S-5	10	6
		Inlet	PM	N-12	8	6-2	9516	S-9	3	2
		Outlet	PM	N-32	6	6-1	9879	S-8	6	3
12-12-87	3	Inlet	SV	N-1	8	96-1	9518	S-3	9	5
		Outlet	SV	N-2	6	72-1	9517	S-5	10	6
		Inlet	PM	N-12	8	6-2	9516	S-9	3	2
		Outlet	PM	N-32	6	6-1	9879	S-8	6	3

[a] Inlet - Spray dryer inlet
Outlet - Baghouse outlet

[b] SV - PCDD/PCDF
PM - Particulate/Metals

[c] Console includes dry gas meter and orifice meter.

[d] Unique number given to all components of a particular train during test program.

TABLE J-2. DESCRIPTION OF EQUIPMENT USED DURING THE MAINE ENERGY RECOVERY CO. TEST PROGRAM
DECEMBER 9-12, 1987

Equipment	Description
General	
Nozzles	Nickel, button-hook design
Pitot tubes	Type S pitot tube assembly--calibrated
Thermocouples	Type K
Probe liners	Borosilicate glass
Manometers	Inclined oil-type 0-1 in/10 in H_2O
Filter media	Whatman 934 AH-glass fiber (semivolatile organics); Whatman QM-A-quartz fiber (particulates/metals)
Filter support	Teflon®-coated stainless steel
Train glassware	Borosilicate glass with threaded/teflon® ferruled joints
Silica gel	Indicating type, 6-16 mesh
Probe brushes	Inert natural bristles with stainless steel handle (semivolatile organics). Inert nylon bristles with stainless steel handle (particulates); not used for metals.
For PCDD/PCDF	
Solid sorbent module	XAD-2 resin
Water	HPLC quality
Acetone	American Burdick & Jackson Product 010
Hexane	American Burdick & Jackson Product 216
Wash bottles	Teflon®
Sample bottles	Amber borosilicate glass with teflon®-lined lids
For Particulates/Metals	
Acetone	American Burdick & Jackson Product 010
Water	HPLC quality
Nitric acid	Bakers Instra-Analyzed
Hydrogen peroxide	ACS reagent grade
Potassium Permaganate	ACS reagent grade
Sulfuric Acid	ACS reagent grade
Sodium hydroxide	ACS reagent grade
Wash bottles	Teflon®
Sample bottles	Amber borosilicate glass with teflon®-lined lids
Ash scoops	Teflon®-coated aluminum
Ash buckets	New 5-gal steel point cans

TABLE J-2 (continued)

Equipment	Description
Continuous Emissions Monitoring	
Heat traced sample lines	Teflon, 3/8"
Manifolds	Stainless steel
THC analyzer	Beckman 402, heated FID
SO_2 analyzers	Whitacre
CO analyzers	Horiba PIR-2000L, Nondispersive infrared
O_2 analyzers	Beckman 742 and 7003, polarographic
CO_2 analyzers	Horiba PIR-2000S, Nondispersive infrared
NO_x analyzer	Bendix 8101-B, chemiluminescent

BAROMETER CALIBRATION
Data Sheet

Field Barometer No. X-4029

Date 1-8-88

Project No. 8984/8910

Initial DS

Location ____________

Reference Barometer No. X-4857

Ref. Barometer Reading 29.60

Ref. Barometer Temp. (F) 73

Temperature Correction for Hg Reference Barometer

Reading X (1 - Correction Factor) = Corrected Reading

29.60 X (1 - .00412) = 29.478

Corrected Hg Reference Barometer Reading = 29.48

Field Barometer Reading 29.48

Error of Field Barometer

ZERO Inches of Hg

Allowed Error = ± 0.10 Inches of Hg

POST-TEST CALIBRATION SUMMARY
FOR METHOD 5

Plant MERC

Calibration Dates 12/28/87 -

Field Dates

Calibration By DS

Console No.	Gas Meter - Y Calib.		Post-Test ± 5% of Pretest?	DGM Thermometers ± 10.8° F of Scale?
	Pretest	Post-Test		
10	1.127	1.1381	YES	YES
3	1.0158	1.0182	YES	YES
9	1.0229	1.0153	YES	YES
6	.9870	.9813	YES	YES

Stack T.C. No.	Avg. Stack Temp. °F	Calibration Temp. °F	Error °R	Post-Test ± 1.5% of Calib. Std.?
6-1	271	295.5	4°	YES
72-1	270	302.0	3.3°	YES
96-1	371	374.5	2.6°	YES
6-2	380	372.5	3.1	YES

Barometer No.	Calibration Readings, In. Hg		Post-Test ± 0.1 In. of Std. Baro.?
	Field Baro.	Std. Baro.	
X-4029	29.48	~~29.60~~ 29.48	YES

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 1-11-87

Project number 8910L02

Ambient temperature 70 °F

Barometric pressure N/A in. Hg

Calibrator DS

Reference: mercury-in-glass ASTM-18F

Average stack temp. ______ °F

Serial no. 613947

Thermocouple number	Source[b] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[c] %
6-1	OIL BATH	295.5	299.5	.53%
72-1	"	302.0	305.3	.43%
96-1	"	374.5	377.1	~~.53%~~ .31%
6-2	"	372.5	375.6	.37%

[b] Type of calibration system used.

[c] $$\left[\frac{(\text{ref temp, °F} + 460) - (\text{test thermom temp, °F} + 460)}{\text{ref temp, °F} + 460}\right] 100 \leq 1.5\%$$

STACK TEMPERATURE METER CALIBRATION DATA FORM

Project no. 8910602

Date 1-11-88

☐ Potentiometer

☒ Pyrometer number SEE BELOW

Ambient temperature 70 °F

Barometric pressure N/A in. Hg

Calibrator DS

Reference: mercury-in-glass ASTM-68F

Average stack temp. ______ °F

Serial no. 613947

Temperature reference type/SN	Source[b] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F		Temperature difference,[c] %
			METER #	°F	
REF #1	OIL BATH	299	9879	306	.92%
11	11	308	9517	310	.26%
11	11	366	9516	372	.72%
11	11	366	9518	369	.36%

[b] Type of calibration system used.

[c] $$\left[\frac{(\text{ref temp, °F} + 460) - (\text{test thermom temp, °F} + 460)}{\text{ref temp, °F} + 460}\right] 100 \leq 1.5\%$$

STACK TEMPERATURE METER CALIBRATION DATA FORM

Project no. 8723 L9

Date 10-26-87

☐ Potentiometer

☒ Pyrometer number 9519 , 9879

Ambient temperature 74 °F

Barometric pressure 29.11 in. Hg

Calibrator DS

Reference: mercury-in-glass ASTM 63 F

Average stack temp. 65.5 °F

Serial no. A01653

Temperature reference type/SN	Source[b] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[c] %
T-14	WATER BATH	66.1	66° 9519	.02%
T-14		66.1	66° 9879	.02%

---

[b] Type of calibration system used.

[c] $$\left[\frac{(\text{ref temp, °F} + 460) - (\text{test thermom temp, °F} + 460)}{\text{ref temp, °F} + 460}\right] 100 \leq 1.5\%$$

STACK TEMPERATURE METER CALIBRATION DATA FORM

Project no. 8691-L 15

Date 9-30-87

☐ Potentiometer
☒ Pyrometer number See Below

Ambient temperature 72 °F

Barometric pressure 29.40 in. Hg

Calibrator RCS

Reference: mercury-in-glass ASTM 69F

Average stack temp. 416-424 °F

Serial no. 566098

Temperature reference type/SN	Source[b] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[c] %
6-42	Oil Bath	419	9516 424	[redacted] 0.57%
6-42	" "	419	9517 423	0.46%
6-42	" "	418	9879 423	0.57%
6-42	" "	417	302332 418	0.11%

[b] Type of calibration system used.

[c] $$\left[\frac{(\text{ref temp, °F} + 460) - (\text{test thermom temp, °F} + 460)}{\text{ref temp, °F} + 460}\right] 100 \leq 1.5\%$$

STACK TEMPERATURE METER CALIBRATION DATA FORM

Project no. 8906-L3

Date 9-4-87

☐ Potentiometer

☒ Pyrometer number See Below

Ambient temperature 70 °F

Barometric pressure 29.20 in. Hg

Calibrator RCS

Reference: mercury-in-glass ASTM 65 F

Average stack temp. 145 °F

Serial no. 05181

Temperature reference type/SN	Source[b] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[c] %
96-1	Oil Bath	146.5	9516 Pyro, 145°F	0.25
96-2	Oil Bath	144.8	9880 Pyro, 144°F	0.13

[b] Type of calibration system used.

[c] $$\left[\frac{(\text{ref temp, °F} + 460) - (\text{test thermom temp, °F} + 460)}{\text{ref temp, °F} + 460}\right] 100 \leq 1.5\%$$

STACK TEMPERATURE METER CALIBRATION DATA FORM

Project no. 8678-L2 MS+D

Date 8-17-87

☐ Potentiometer

☒ Pyrometer number 9517, 9518

Ambient temperature 70 °F

Barometric pressure 29.14 in. Hg

Calibrator RCS

Reference: mercury-in-glass ASTM 65 F

Average stack temp. 168.3 °F

Serial no. 05181

Temperature reference type/SN	Source[b] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Pyrometer	Temperature difference,[c] %
T-21	Oil Bath	163.5	161	9518	0.4%
T-21	Oil Bath	164.8	165	9517	0.03%

---

[b] Type of calibration system used.

[c] $$\left[\frac{(\text{ref temp, °F} + 460) - (\text{test thermom temp, °F} + 460)}{\text{ref temp, °F} + 460}\right] 100 \leq 1.5\%$$

MIDWEST RESEARCH INSTITUTE

PITOT TUBE CALIBRATION FORM

Pitot Tube Number: S-3

Calibrated by: RCS, VW

Date: ~~7-1-86~~ 1-7-86 RCS

C_{pstd} = .99

$\Delta P_{std} \approx$ 0.55 or as required

	Side "A" (in. H_2O)				Side "B" (in. H_2O)			
Run No.	ΔP_{std}	$\Delta P_{(s)}$	$C_{p(s)}$	Dev.	ΔP_{std}	$\Delta P_{(s)}$	$C_{p(s)}$	Dev.
1	.590	.825	.837	-.001	.588	.826	.835	+.002
2	.591	.823	.839	+.001	.585	.828	.832	-.001
3	.590	.823	.838	0	.585	.829	.832	-.001
		Average $\bar{C}_p^{A}$	.838			Average $\bar{C}_p^{B}$	.833	

C_{Pstd} = Pitot tube coefficient of standard type pitot tube

$$C_{p(s)} = C_{Pstd} \sqrt{\frac{\Delta P_{std}}{\Delta P_{(s)}}}$$

Dev. = $C_{p(s)} - \bar{C}_p$ (must be ≤ 0.01)

C_p(difference) = $\left|\text{Average}_A - \text{Average}_B\right|$ = .005 (must be ≤ 0.01)

$$\sigma \text{ (side A or B)} = \sum_{1}^{3} \frac{\left|C_{p(s)} - \bar{C}_p \text{ (A or B)}\right|}{3}$$ (must be ≤ 0.01)

$\sigma \bar{A}$ = 0

$\sigma \bar{B}$ = 0

Avg. $\bar{C}_p$ = .836

MIDWEST RESEARCH INSTITUTE

PITOT TUBE CALIBRATION FORM

Pitot Tube Number: S-5

Calibrated by: RCS, VW

Date: 1-7-86

C_{pstd} = .99

$\Delta P_{std} \approx$ 0.55 or as required

	Side "A" (in. H_2O)				Side "B" (in. H_2O)			
Run No.	ΔP_{std}	$\Delta P_{(s)}$	$C_{p(s)}$	Dev.	ΔP_{std}	$\Delta P_{(s)}$	$C_{p(s)}$	Dev.
1	.591	.831	.835	0	.587	.808	.844	0
2	.590	.830	.835	0	.585	.807	.843	-.001
3	.588	.828	.834	-.001	.585	.805	.844	0
		Average $\bar{C}_p$ A	.835			Average $\bar{C}_p$ B	.844	

C_{Pstd} = Pitot tube coefficient of standard type pitot tube

$$C_{p(s)} = C_{Pstd}\sqrt{\frac{\Delta P_{std}}{\Delta P_{(s)}}}$$

Dev. = $C_{p(s)} - \bar{C}_p$ (must be ≤ 0.01)

C_p(difference) = $\left|\text{Average}_A - \text{Average}_B\right|$ = .009 (must be ≤ 0.01)

$$\sigma \text{ (side A or B)} = \sum_{1}^{3} \frac{\left|C_{p(s)} - \bar{C}_p \text{ (A or B)}\right|}{3}$$ (must be ≤ 0.01)

σA = .0003

σB = .0003

Avg. $\bar{C}_p$ = .840

MIDWEST RESEARCH INSTITUTE

PITOT TUBE CALIBRATION FORM

Pitot Tube Number: pitot 5-8

Calibrated by: Shelte / Griffin

Date: 12/23/86

BP 29.05

T - 22.5 °C

C_{pstd} =

ΔP_{std} ≈ 0.55 or as required

	Side "A" (in. H_2O)				Side "B" (in. H_2O)			
Run No.	ΔP_{std}	$\Delta P_{(s)}$	$C_{p(s)}$	**Dev.**	ΔP_{std}	$\Delta P_{(s)}$	$C_{p(s)}$	**Dev.**
1	.575	.763	.868	.001	.575	.766 ~~.805~~	.866	0
2	.575	.762	.869	0	.574	.765	.866	0
3	.574	.760	.869	0	.576	.766	.867	.001
		Average $\bar{C}_p$ A	.869			Average $\bar{C}_p$ B	.866	

C_{Pstd} = Pitot tube coefficient of standard type pitot tube

$$C_{p(s)} = C_{Pstd} \sqrt{\frac{\Delta P_{std}}{\Delta P_{(s)}}}$$

Dev. = $C_{p(s)} - \bar{C}_p$ (must be ≤ 0.01)

C_p(difference) = $\left|\text{Average}_A - \text{Average}_B\right|$ = .001 (must be ≤ 0.01)

$$\sigma \text{ (side A or B)} = \sum_{1}^{3} \frac{\left|C_{p(s)} - \bar{C}_p \text{ (A or B)}\right|}{3} \quad \text{(must be} \le 0.01)$$

σA = .0003

σB = .0003

Avg. $\bar{C}_p$ = .868

MIDWEST RESEARCH INSTITUTE

PITOT TUBE CALIBRATION FORM

Pitot Tube Number: 5-9 w/NOZZLE N-24 on probe AL-1

Calibrated by: Stultz/Griffin

Date: 12/23/86
BP 29.10
T 22.5

C_{pstd} = .99

$\Delta P_{std} \approx$ 0.55 or as required

	Side "A" (in. H_2O)				Side "B" (in. H_2O)			
Run No.	ΔP_{std}	$\Delta P_{(s)}$	$C_{p(s)}$	Dev.	ΔP_{std}	$\Delta P_{(s)}$	$C_{p(s)}$	Dev.
1	.573	.776	.859	0	.573	.764	.866	.002
2	.574	.777	.859	0	.575	.760	.870	.002
3	.574	.778	.859	0	.577	.765	.868	0
		Average $\bar{C}_p$ A	.859			Average $\bar{C}_p$ B	.868	

C_{Pstd} = Pitot tube coefficient of standard type pitot tube

$$C_{p(s)} = C_{Pstd} \sqrt{\frac{\Delta P_{std}}{\Delta P_{(s)}}}$$

Dev. = $C_{p(s)} - \bar{C}_p$ (must be ≤ 0.01)

C_p(difference) = $\left|\text{Average}_A - \text{Average}_B\right|$ = .009 (must be ≤ 0.01)

$$\sigma \text{ (side A or B)} = \sum_{1}^{3} \frac{\left|C_{p(s)} - \bar{C}_p \text{ (A or B)}\right|}{3} \quad \text{(must be} \leq 0.01)$$

σA = 0

σB = .001

MIDWEST RESEARCH INSTITUTE

PITOT TUBE CALIBRATION FORM

Pitot Tube Number: S-11 **Calibrated by:** RCS, VW

Date: 1-7-86 C_{pstd} = .99

$\Delta P_{std} \approx$ 0.55 or as required

	Side "A" (in. H_2O)				Side "B" (in. H_2O)			
Run No.	ΔP_{std}	$\Delta P_{(s)}$	$C_{p(s)}$	Dev.	ΔP_{std}	$\Delta P_{(s)}$	$C_{p(s)}$	Dev.
1	.582	.813	.838	0	.585	.810	.841	0
2	.585	.818	.837	.001	.585	.812	.840	.001
3	.585	.816	.838	0	.585	.810	.841	0
		Average $\bar{C}_p$ A	.838			Average $\bar{C}_p$ B	.841	

C_{Pstd} = Pitot tube coefficient of standard type pitot tube

$$C_{p(s)} = C_{Pstd} \sqrt{\frac{\Delta P_{std}}{\Delta P_{(s)}}}$$

Dev. = $C_{p(s)} - \bar{C}_p$ (must be ≤ 0.01)

C_p(difference) = $\left| \text{Average}_A - \text{Average}_B \right|$ = .003 (must be ≤ 0.01)

$$\sigma \text{ (side A or B)} = \sum_{1}^{3} \frac{\left| C_{p(s)} - \bar{C}_p \text{ (A or B)} \right|}{3}$$ (must be ≤ 0.01)

σA = .0003

σB = .0003

Avg. $\bar{C}_p$ = .840

NOZZLE CALIBRATION DATA FORM

Date 2-20-85 Calibrated by RCS

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm ([✓ in.])	D_{avg}[c]
	D_1, mm ([✓ in.])	D_2, mm ([✓ in.])	D_3, mm ([✓ in.])		
N-1	.162	.162	.161	.001	.162
N-2	.184	.182	.182	.002	.183
N-3	.275	.274	.276	.002	.275
N-4	.305	.306	.306	.001	.306
N-5	.381	.379	.380	.002	.379
N-6	.410	.413	.411	.003	.411

where:

[a] $D_{1,2,3,}$ = three different nozzles diameters, mm (in.); each diameter must be within (0.025 mm) 0.001 in.

[b] ΔD = maximum difference between any two diameters, mm (in.), $\Delta D \leq$ (0.10 mm) 0.004 in.

[c] D_{avg} = average of D_1, D_2, and D_3.

NOZZLE CALIBRATION DATA FORM

Date 7-11-86 Calibrated by RCS

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
N - 3	(.270)	(.272)	(.272)	(.002)	.271 -
N- 25	(.373)	(.373)	(.373)	Zero	.373 -

where:

[a] $D_{1,2,3,}$ = three different nozzles diameters, mm (in.); each diameter must be within (0.025 mm) 0.001 in.

[b] ΔD = maximum difference between any two diameters, mm (in.), ΔD $\leq$(0.10 mm) 0.004 in.

[c] D_{avg} = average of D_1, D_2, and D_3.

NOZZLE CALIBRATION DATA FORM

Date 6-4-87 Calibrated by RCS

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
N-12	(.183)	(.184)	(.184)	(.001)	.184
N-13	(.275)	(.277)	(.274)	(.003)	.275
N-14	(.311)	(.312)	(.311)	(.001)	.311
N-18	(.520)	(.520)	(.523)	(.003)	.521
N-26	(.400)	(.403)	(.403)	(.003)	.402
N-17	(.519)	(.522)	(.521)	(.003)	.521
N-35	(.376)	(.375)	(.376)	(.001)	.376
N-36	(.408)	(.407)	(.406)	(.002)	.407

where:

[a] $D_{1,2,3,}$ = three different nozzles diameters, mm (in.); each diameter must be within (0.025 mm) 0.001 in.

[b] ΔD = maximum difference between any two diameters, mm (in.), $\Delta D \leq$(0.10 mm) 0.004 in.

[c] D_{avg} = average of D_1, D_2, and D_3.

NOZZLE CALIBRATION DATA FORM

Date 4-21-87 Calibrated by RCS

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
N-22	(.181)	(.182)	(.180)	(.002)	.181 –
N-32	(.181)	(.181)	(.182)	(.001)	.181 –
N-23	(.283)	(.284)	(.282)	(.002)	.283 –

where:

$^{a}D_{1,2,3,}$ = three different nozzles diameters, mm (in.); each diameter must be within (0.025 mm) 0.001 in.

^{b} ΔD = maximum difference between any two diameters, mm (in.), $\Delta D \leq$(0.10 mm) 0.004 in.

^{c} D_{avg} = average of D_1, D_2, and D_3.

Operator DS Date 1-14-83 Meter box number 3 Plant MERC

Barometric pressure, P_b = 29.53 in. Hg Dry gas meter number — Pretest Y 1.0158

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i
	Wet test meter (V_w), ft^3 *	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter Inlet (t_{d_i}), °F	Dry gas meter Outlet (t_{d_o}), °F	Dry gas meter Average (t_d)[a], °F				$\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
.82	4.957	4.981	72.25	93.17	79.33	86.25	10.06	6"	1.01927	1.90307
.82	5.9496	6.001	72.49	94.57	81.43	88.0	12.08	6"	1.01823	1.89936
.82	4.959	5.020	72.57	95.50	83.33	89.41	10.07	6"	1.01701	1.89420
									Y =	1.0182

* INCLUDES CORRECTION FACTOR OF .9916

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d

AVG ΔH@ 1.899

where

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in. H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y ±0.05Y.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Quality Assurance Handbook M4-2.4A

Operator RCS Date 10-7-87 Meter box number 3 Plant Chicago NW 8691-L15

Barometric pressure, P_b = 29.34 in. Hg Dry gas meter number 614697 Pretest Y 1.0381

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i
	Wet test meter (V_w), ft^3 *	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter Inlet (t_{d_i}), °F	Dry gas meter Outlet (t_{d_o}), °F	Dry gas meter Average[a] (t_d), °F				$\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
0.8	4.958	4.965	72.5	90.0	76.0	83.0	10.083	6	1.0162	ΔH@ = 1.891
0.8	4.958	4.990	72.5	93.5	78.5	86.0	10.098	6	1.0167	1.888
0:8	4.958	5.019	72.58	95.33	80.83	88.08	10.162	6	1.0146	1.904
									Y =	1.0158

* Includes Wet Meter Correction of 0.9916

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d

where

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

Avg. ΔH@ = 1.894

t_c

t

Δ

Y

of t_{d_i} and t_{d_o}, °F.

ns;

```
CONSOLE NO  3.
BARO= 29.34
ORFICE=  0.80
WET TEMP= 72.50
DRY T IN= 90.00
DRY T OUT= 76.00
AVG DRY T= 83.00
TIME,MIN= 10.083
WET V=  4.95800
DRY V=  4.96500

^H CAL=  1.89129
 Y CAL=  1.01624
```

```
CONSOLE NO  3.
BARO= 29.34
ORFICE=  0.80
WET TEMP= 72.50
DRY T IN= 93.50
DRY T OUT= 78.50
AVG DRY T= 86.00
TIME,MIN= 10.098
WET V=  4.95800
DRY V=  4.99000

^H CAL=  1.88811
 Y CAL=  1.01673
```

```
CONSOLE NO  3.
BARO= 29.34
ORFICE=  0.80
WET TEMP= 72.58
DRY T IN= 95.33
DRY T OUT= 80.83
AVG DRY T= 88.08
TIME,MIN= 10.161
WET V=  4.95800
DRY V=  5.01900

^H CAL=  1.90421
 Y CAL=  1.01456
```

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Quality Assurance Handbook M4-2.4A

Operator DS Date 1-20-88 Meter box number 6 Plant MERC

Barometric pressure, P_b = 28.98 in. Hg Dry gas meter number — Pretest Y .9870

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i
	Wet test meter (V_w), ft^3 *	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter						$\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
				Inlet (t_{d_i}), °F	Outlet (t_{d_o}), °F	Average (t_d),[a] °F				
.51	4.956	5.152	72.4	86.67	77.83	82.25	12.006	6"	.97852	1.66805
.51	4.958	5.145	72.4	87.17	79.33	83.25	12.031	6"	.98206	1.66900
.51	4.958	5.142	72.4	87.33	80.00	83.66	12.035	6"	.98338	1.66785
									Y =	.9813

* INCLUDES CORRECTION FACTOR OF .9916

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d

where

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

AVG ΔH@ 1.6683

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in. H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y $\pm 0.05Y$.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Operator DS Date 10-27-87 Meter box number 6 Plant OCC 872369

Barometric pressure, P_b = 29.38 in. Hg Dry gas meter number 614696 Pretest Y .9914

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i
	Wet test meter (V_w), ft^3*	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter						$\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
				Inlet (t_{d_i}), °F	Outlet (t_{d_o}), °F	Average (t_d),^{a} °F				
.75	4.961	5.140	71.08	86.5	79.017	82.75	10.26	8"	.9846	ΔH@ 1.8123
.75	4.961	5.140	71.10	89.67	80.017	84.84	10.26	8"	.9883	ΔH@ 1.8085
.75	4.961	5.152	71.20	90.3	81.83	86.06	10.26	8"	.9880	ΔH@ 1.8031
									Y = .9870	

* INCLUDES CORRECTION FACTOR OF .9916

^{a} If there is only one thermometer on the dry gas meter, record the temperature under t_d

where

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

AVG ΔH@ 1,8079

```
CONSOLE NO  6.
BARO=29.38
ORFICE=  0.75
WET TEMP= 71.08
DRY T IN= 86.50
DRY T OUT= 79.01
AVG DRY T= 82.75
TIME,MIN= 10.263
WET V=  4.96100
DRY V=  5.14000

^H CAL=  1.81227
 Y CAL=  0.98455
```

```
CONSOLE NO  6.
BARO= 29.38
ORFICE=  0.75
WET TEMP= 71.10
DRY T IN= 89.67
DRY T OUT= 80.01
AVG DRY T= 84.84
TIME,MIN= 10.261
WET V=  4.96100
DRY V=  5.14000

^H CAL=  1.80346
 Y CAL=  0.98829
```

```
CONSOLE NO  6.
BARO= 29.38
ORFICE=  0.75
WET TEMP= 71.20
DRY T IN= 90.30
DRY T OUT= 81.83
AVG DRY T= 86.06
TIME,MIN= 10.261
WET V=  4.96100
DRY V=  5.15200

^H CAL=  1.80309
 Y CAL=  0.98801
```

e average of t_{d_i} and t_{d_o}, °F.

l three runs;

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Operator DS Date ~~12~~ 1-14-87 Meter box number 9 Plant MERC

Barometric pressure, P_b = 29.40 in. Hg Dry gas meter number — Pretest Y 1.0229

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i
	Wet test meter (V_w), ft^3 *	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter						$\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460}$
				Inlet (t_{d_i}), °F	Outlet (t_{d_o}), °F	Average (t_d)[a], °F				
.56	4.958	5.017	73.35	96.83	83.17	90.00	11.60	9"	1.01766	1.73097
.56	~~5.017~~ DS 4.957	5.044	73.53	98.50	86.17	92.33	11.581	9"	1.01596	1.71788
.56	4.958	5.053	73.73	95.00	87.83	94.41	11.57	9"	1.01229	1.71215
									Y =	1.0153

P_b=29.36

* INCLUDES CORRECTION FACTOR OF .9916

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d

where

AVG ΔH@ 1.720

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in. H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y $\pm 0.05Y$.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Quality Assurance Handbook M4-2.4A

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Operator R. Stultz Date 10-28-86 Meter box number 9 Plant Pyrochem 8640L-2

Barometric pressure, P_b = 29.17 in. Hg Dry gas meter number ______ Pretest Y 0.9442

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i
	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter						$\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
				Inlet (t_{d_i}), °F	Outlet (t_{d_o}), °F	Average[a] (t_d), °F				
0.5	4.9969	4.966	74.4	90.2	78.0	84.1	12.15	8	1.0232	ΔH@ = 1.705
0.5	4.9969	4.996	74.4	94.33	81.0	87.7	12.162	8	1.0237	1.699
0.5	4.9969	5.026	74.4	96.33	83.67	90.0	12.173	8	1.0219	1.694
									Y =	1.0229

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d

where

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

Avg. ΔH@ = 1.699

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in. H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y ±0.05Y.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Quality Assurance Handbook M4-2.4A

Operator DS Date 1-12-88 Meter box number 10 Plant MERC

Barometric pressure, P_b = 29.03 in. Hg Dry gas meter number — Pretest Y ~~1.0973~~ 1,127

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i
	Wet test meter (V_w), ft^3 ✻	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter: Inlet (t_{d_i}), °F	Dry gas meter: Outlet (t_{d_o}), °F	Dry gas meter: Average[a] (t_d), °F				$\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
1.7	4.956	4.516	72.51	101.83	84.13	92.98	7.085	20	1.1347	1.97711
1.7	4,960	4.508	72.83	99.33	85.67	92.50	7.090	20	1.1360	1.9735
1.7	4,958	4,474	72.75	97.67	86.56	92.11	7.088	20	1.1435	1.9704
									Y =	1,1381

✻ INCLUDES CORRECTION FACTOR OF .9916

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d

AVG ΔH@ 1,9737

where

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in. H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y ±0.05Y.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Quality Assurance Handbook M4-2.4A

Operator STICH Date 8-4-86 Meter box number 10 Plant Dupont-Louisville

Barometric pressure, P_b = 29.31 in. Hg Dry gas meter number 644735 Pretest Y 1.0973

Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3 *	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average (t_d),ª °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i $\dfrac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
1.5	10.016	9.170	66.0	81.3	75.8	78.6	15.49	1	1.1142	ΔH@ = 2.004
1.5	10.023	9.098	66.0	85.2	76.5	80.9	15.50	1	1.1286	ΔH@ = 2.001
1.5	10.017	9.027	66.0	86.8	77.5	82.2	15.51	1	1.1396	ΔH@ = 2.002
									Y =	1.127

* WTM corrected by Correction Factor of .99938

ª If there is only one thermometer on the dry gas meter, record the temperature under t_d

where

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

$\Delta H@_{Avg} = 2.002$

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in. H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y ±0.05Y.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

APPENDIX K

FIELD TEST LOGS

K.1 Daily Sampling Log Summary K-2
K.2 Field Operations Log K-4
K.3 Sampling Location Logs K-8
K.4 Field Laboratory and Sample Identification Log - Particulate/Metals K-17
K.5 Field Laboratory and Sample Identification Log - Semivolatile Organics K-36
K.6 Process Sample Identification Log K-52
K.7 Field Sample Traceability Logs K-59

K.1 Daily Sampling Log Summary

TABLE K-1. DAILY SAMPLING LOG SUMMARY

Date/run	Dioxin/Furan		Particulate/Metals		CEM	Process Samples	Notes
	Sampling time	Port	Sampling time	Port	Time	Time	
12-9-87	Spray Dryer Inlet					Baghouse Ash	Plant Operations: No problems occurred during sampling until the F.D. fan on Unit A went down before the last port could be sampled. Sampling Operations: No problems occurred during sampling except that a leak was found in the Method 3 train diaphram pump at the Baghouse outlet after Orset analysis results became suspect. The normal post-test leak check had passed. An additional leak check procedure was subsequently employed.
Run no. 1	15:35-16:55	2	15:30-16:50	1	14:36-18:55	16:30-18:20	
	17:23-18:43	3	17:18-18:38	2		Cyclone Ash	
	Spray Dryer Outlet				14:43-18:57	16:20-18:25	
	Baghouse Outlet				13:21-18:55	Bottom Ash	
	15:35-16:55	2	15:32-16:52	1		16:10-18:10	
	17:20-18:40	3	17:19-18:39	2		RDF	
						16:05-18:05	
						Lime Slurry	
						17:45	
12-10-87	Spray Dryer Inlet				12:17-18:03	Baghouse Ash	Plant Operations: Slurry injection rate to Spray Dryer was increased (- doubled) at 1445. Otherwise there were no problems during sampling. Sampling Operations: Organics train at Baghouse outlet stopped (1302-1305) to change XAD cartridge; train stopped (1525-1530) to change silica gel and recover part of condensate. Train vacuum high throughout run.
Run no. 2	12:45-14:05	2	12:50-14:10	1		13:40-18:30	
	14:31-15:51	3	14:35-15:55	2		Cyclone Ash	
	16:36-17:56	1	16:40-18:00	3		13:52-18:25	
	Spray Dryer Outlet				12:39-18:03	Bottom Ash	
	Baghouse Outlet				09:58-18:02	13:35-16:30	
	12:47-13:02	2	12:46-14:06	1		RDF	
	13:05-14:10	2				13:30-16:55	
	15:00-15:25	3	14:33-15:53	2		Lime Slurry	
	15:30-16:25	3				15:55	
	16:37-17:57	1	16:36-17:56	3			
12-12-87	Spray Dryer Inlet				10:55-18:50	Baghouse Ash	Plant Operations: RDF feeder problem at 1140. Turbine tripped and RDF feed lost at 1520. Run cut short due to multiple plant problems. Sampling Operations: Post test leak check for organics train at Baghouse outlet failed. Volume sampled in port 3 is suspect.
Run no. 3	11:20-11:40	2	11:24-11:39	1		13:10-18:30	
	12:00-13:00	2	12:04-13:09	1		Cyclone Ash	
	13:25-14:45	3	13:29-14:49	2		13:00-18:35	
	15:10-15:25	1	15:14-15:24	3		Bottom Ash	
	18:15-18:35	1	18:19-18:34	3		Not collected	
	Spray Dryer Outlet				09:28-19:20	RDF	
	Baghouse Outlet				09:29-19:16	13:00-14:50	
	11:16-11:41	2	11:17-11:42	1		Lime Slurry	
	12:01-12:56	2	12:00-12:55	1		14:45	
	13:26-14:46	3	13:25-14:45	2			
	15:11-15:26	1	15:10-15:25	3			
	18:21-18:36	1	18:15-18:35	3			

K.2 Field Operations Log

Project No. 8910L0212 Date of Work: N/A Work Performed by: J Farmer J.
Title or Purpose: Test Log (MERC) Continued from: MERC

Thursday, December 3, 1987

G. Scheil, J. Farmer, D. Griffin, S. Hanna, and L. Cone travelled to MERC area (Old Orchard Beach, ME) by air.
D. Marsh and L. Kenner travelled from Niagara Falls, N.Y. (O'Brien & Gere project) with equipment by truck.

Friday, Dec. 4.

0800-1300/1400-1800 Unpacked truck and begin set up
R. Neubecht travelled by air.

Saturday, Dec 5

0700-1230/1400-1900 Continued set up.
Proof rinsed 4 trains. Began building probes

Sunday, Dec 6

Scheil, Farmer, and Neubecht purchased materials, rented car, reviewed progress on set up and adjusted planned set up routine to be more efficient.
J. Cammarri, D. Soderberg, and R. Nelson travelled by air.

Monday Dec 7

Neubecht 0530 picked up probes at airport.
0700 Continued set-up. Completed probe building.
2100/2200 Set-up about 95% complete.
S. Schriever travelled by air.

Tuesday, Dec 8

0700 Finalize set up. Ready to test at 12 noon.
Plant had problems with ground fault off site.
Units tripped twice during day. Testing postponed.
1600/1700 Scanned test locations.

Wednesday, Dec 9

0900/1000 Set-up. Ready to test at 1330.
1530-1830 Sampled 2 ports each location (2/3rds of complete run)

Continued to:
Entered by:
Date:

Disclosed to and Understood by:
1. Date:
2. Date:

Project No. 8910L0212 **Date of Work:** **Work Performed by:**

Title or Purpose: Test Log (MERL) **Continued from:** 32

Wednesday, Dec. 9 cont'd

F.D. fan down on Unit A. Rubberbands did not correct the problem. Run stopped and samples recovered.

Thursday, Dec 10

0700 At Plt. Setup. F.D. fan replaced.

0800 minor feeder problem corrected.

1015 Ready to test

Plant has feeder line problems Crew at Lunch 1100-1200

1245 Told to start Began run #2 ~1245

1445/1450 Scrubber injection rate increased (doubled)

Had to stop Outlet organic train to replace silica gel and recover condensate.

~1800 end run #2.

Friday, Dec 11

0900 - Plant down - repairing conveyor problems (RDF)

Told (Riley) to be set up by 1100. RAIN!

Ready to test at 1015 - both inlet & outlet.

On hold

Told no test today at 1530.

Saturday, Dec 12

0900 Plant up and running well enough to test.

Ready to test @ 0915

Start Run #3 1120

Shut down 1140 - feeder problem.

Restart (resume) 1200

1520 Plant lost it! Tripped turbine & lost fuel, etc.

On Hold.

Told to start at 1745. Crew ready to start 1805.

1800 Told not to start. Maybe 15-20 minutes.

Plan to start at 1815. 1810 On hold again.

1938 Stop testing & recover. Multiple plant problems

Continued to:

Disclosed to and Understood by:

Entered by:

1. **Date:**

Date:

2. **Date:**

Project No. 8910L0212 **Date of Work:** N/A **Work Performed by:**

Title or Purpose: Test Log (MERC) **Continued from:** 33

Sunday, Dec 13, 1987

0800 Plant running - looks good. Set up

~0830 Plant down - really down. Ready to test @ 1000

Maybe 1030

Maybe 1130

Maybe 1200

1215 Lv site call back @ 1330, 1445, 1530, 1630

Turbine problems / pack up for night 1700.

Monday, Dec 14 Pack up

Continued to:

Disclosed to and Understood by:

Entered by:

1. **Date:**

Date:

2. **Date:**

K.3 Sampling Location Logs

SAMPLING TASK LOG

Plant MERC
Date Dec 9, 1987
Project No. 8910

Plant Location Inlet
Recorded by C. E. Riley

Comments	Run	Sampling Location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
Start	1	Port 1	Metals	1530	16:50	80	
Switched Ports							
	1	Port 2		17:18	18:38	80	
Run discontinued	due	to process	being	Down			
Start	1	Port 2	Semivolatiles	15:35	16:55	80	
Switched Ports							
	1	Port 3		17:23	18:43	80	

SAMPLING TASK LOG

Plant MERC
Date Dec 9, 1997
Project No. 8918

Plant Location Outlet
Recorded by C. E. Riley

Comments	Run	Sampling Location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
Start	1	Port 1	Metals	15:32	16:52	80	
Switched Ports							
	1	Port 2		17:19	18:39	80	
Run discontinued due to process going down!							
Start	1	Port 2	Semi volatile	15:35	16:55	80	
Switched ports							
	1	Port 3		17:20	18:40	80	
Run discontinued due to process shut down!							

SAMPLING TASK LOG

Plant MERC
Date Dec 10, 1987
Project No. 8910-L-02-12

Metals Train #2
Plant Location Inlet-SV Train #5
Recorded by S Klamm

Comments	Run	Sampling Location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
START	2	Port 2	Semivol's	1245	1405	80	
Port Change 2 → 3							
		Port 3	"	1431	1551	80	
Port Change 3 → 1							
		Port 1		1636	1756	80	
END							
START	2	Port 1	Metals	1250	1410	80	
Port Change 1 → 2							
		Port 2	"	1435	1555	80	
Port Change 2 → 3							
		Port 3	"	1640	1800	80	

SAMPLING TASK LOG

Plant MERC
Date 12-10-87
Project No. 8910L

Plant Location FF Outlet - SV Train
Recorded by J. Surman

Comments	Run	Sampling Location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
Start Train No. 6	2	2	SV	1247	1302	15	
XAD change out							
Resume sampling				1305	1410	65	
Change ports							
Begin sampling		3		1500	1525	25	
Change silica gel & recover							
condensate from last two impingers							
Resume sampling		3		1530	1625	55	
Change ports							
Begin sampling		1		16:37	1757	80	

SAMPLING TASK LOG

Plant MERC

Date 12/10/87

Project No. 8910L

Plant Location Outlet Metals (Train 3)

Recorded by Griffin

Comments	Run	Sampling Location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
Start	2	Port 1	Metals	1246	1406	80	
Port Change 1→2							
		Port 2	"	1433	1553	80	
Port Change 2→3							
		Port 3	"	1636	1756	80	
End Test							

SAMPLING TASK LOG

Plant MERC
Date Dec 12, 1987
Project No. 8910-L-02-12

Plant Location Inlet SV #5 / PM #2
Recorded by S. Klamm / S. Cummins

Comments	Run	Sampling Location (Port)	Pollutant	Clock Time		Elapsed Time (min)	Sample Nos.
				Began	Ended		
START @ 1120 down @ 1140	3	Port 2	Semivols	1120	1140	20	
restart @ 1200		"	"	1200	1300	60	
Change Ports 2 → 3		Port 3	"	1325	1445	80	
Change Ports 3 → 1							
down @ 1525		Port 1	"	1510	1525	15	
restart @ 1815		"	"	1815	1835	20	
test ended 1835						195 TOTAL TIME	
START @ 1124 down @ 1139		Port 1	P/Metals	1124	1139	15	
restart @ 1204		"	"	1204	1309	65	
Change Ports 1 → 2							
		Port 2	"	1329	1449	80	
Change Ports 2 → 3							
down @ 1524		Port 3	"	1514	1524	10	
restart @ 1834 end @ 1819				1819	1834	15	
						185 TOTAL TIME	

SAMPLING TASK LOG

Plant MERC
Date Dec 12, 1987
Project No. 8910

Plant Location FF Outlet
Recorded by March

Comments	Run	Sampling Location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
Start Train #6	3	2-1 →	Semivolatile	1116	1141	25	
Plant down		2-8		1201	1256	55	
Port Change 2 → 3							
		3	"	1326	1446	80	
Port Change 3 → 1							
		1	"	1511	1531	20	

SAMPLING TASK LOG

Plant MERC

Date 12-12-87

Project No. 8910L

Plant Location FF Outlet - Metals Train

Recorded by Brittin

Comments	Run	Sampling Location (Port)	Pollutant	Clock Time Began	Clock Time Ended	Elapsed Time (min)	Sample Nos.
Start	3	Port 1	Metals	1117	1142	25	
Plant down - Restart				1200	1255	55	
Change Ports	~~3→2~~	1→2					
Start	~~2~~	Port 2		1325	1445	80	
Change Ports	~~2~~	2→3					
Start		Port 3		1510	1525	15	
Process down ~~Restart~~							
Restart				1815	1835	20	
Run Ended due to process							
being down.							

K.4 Field Laboratory and Sample Identification Log - Particulate/Metals

1285- 2

MRI Project No.: 8910 (02-12) Performed by (name/date): Laura Kinner 12/4/87
Title/Purpose: Reagent preparation for metals trains

Continued from: – Continued to: p. 1285 -3 Entered by: Verified by:
Witnessed by: Reviewed by: Validated by:
Witnessed by:
(signature/date) (initials/date) (initials/date)

- Acid Kmno4 Solution
  800 mls diionized distilled water
  15.0 g (weighed on MRI 6456 triple beam precalibrated w/ 5, 50g, 500g check weights to w/in 1%)
  100 mls H_2SO_4 from Taylor Chemical Co. Reagent ACS high purity Cat # S5830

Cool + dilute to 1.0 l w/ dionized water

(malinckrodt)
- Nitric acid Hydrogen Peroxide Soln' Lt 5240
  50 mls Conc. HNO_3 lot A14049 Baker for metals
  333 mls 30% H_2O_2

dilute to 1 l w/ dionized water

12-4-87

MRI Project No.: 8510 L(02-12)	**Performed by (name/date):** Laura Kinnes 12/4/87	
Title/Purpose: prep. of Caustic Soln.		
Continued from:	**Continued to:**	
	Entered by: LK	**Verified by:**
Witnessed by:	**Reviewed by:**	**Validated by:**
Witnessed by:		
(signature/date)	(initials/date)	(initials/date)

0.5N NaOH preparation

F.W. 40.00 NaOH Lot 853786 Fischer Scientific

$$N = \frac{FW}{1000\,ml} = \frac{40.00}{1000\,mls} = 1N$$

$$0.5N = 20.00g \Big/ 1000\,mls$$

20g NaOH added to 1.0 l d.I. H_2O

nitric acid Rinse 0.1N

6.3mls (con) nitric acid diluted to 1000mls

LK 12-4-87

MRI Project No.: 8910L(01-12) **Performed by (name/date):** Laura Kunner 12/5/87
Title/Purpose: TARE wt. AVE of Recovery Bottles

Continued from: **Continued to:** **Entered by:** **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

Ambers narrow Mouth

Bottle 1	460.1g
Bottle 2	463.1g
Bottle 3	460.5g
Bottle 4	460.5g
Bottle 5	461.8g
Bottle 6	460.3g

6⟌2766.3

AVE wt. ⇒ 461.05g

JARS

Bottle 1	304.5
2	305.0
3	304.1
4	305.2
5	306.0
6	304.8

6⟌1829.6
304.9

Nalgene Bottles 16 oz

Bottle 1	60.2g
Bottle 2	60.4g
Bottle 3	61.6g
Bottle 4	60.3g
Bottle 5	60.5g
Bottle 6	60.9g

6⟌363.4

AVE wt ⇒ 60.56g

MRI Project No.: 8910L(02-12) **Performed by (name/date):** 01/4/88

Title/Purpose: Summary of sample no. series

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

All Particulate/Metals

11000 Proof Train 1
12000 Proof Train 2 Inlet
13000 Proof Train 3 Outlet

Dec 8 Inlet Blank was new train remarked Train 1
Original Train 1 became Train 3 to replace broken Train 3
Therefore ∴

11000 Proof New Train 3 for Outlet
12000 Proof Train 2 for Inlet
13000 Obsolete
14000 Proof New Train 1 for Field Blank (No Lab data sheet for this?)
15000 Field Blank Train 1 for Inlet
16000 Field Blank Train 1 for Outlet

MRI Project No.: 8910 (01-12) **Performed by (name/date):** Laura Kimes 12/5/87

Title/Purpose: Proof rinses of metals train

Continued from: **Continued to:** **Entered by:** LRK **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 **11001**
proof BL TR #1 PM RIN AC
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **11002**
proof BL TR #1 PM RIN NI
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

Comb. w/11005, 11006 resp.

NO Sample 11003
NO Cyclone Catch

This train became train 3 after it (#3) fell off monorail. another set of glassware was proofed and used to build another train 1 BLK

MERC 8910L02-12 **11004**
proof BL TR #1 PM FILTER
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **11005**
proof BL TR #1 PM FR HLF AC
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **11006**
proof BL TR #1 PM FR HLF NI
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **11007**
proof BL TR #1 PM BCK HALF
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **11008**
proof BL TR #1 PM KMnO4
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **11009**
proof BL TR #1 PM CAUSTIC
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **14004**
proof BL TR #1 PM FILTER
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 **14005**
proof BL TR #1 PM FR HLF AC
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 **14006**
proof BL TR #1 PM FR HLF NI
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 **14007**
proof BL TR #1 PM BCK HALF
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 **14008**
proof BL TR #1 PM KMnO4
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 **14009**
proof BL TR #1 PM CAUSTIC
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

14001 + 14002 not inc. in 2nd proof used same probe.

1285- 16

MRI Project No.: 8910(L)012	**Performed by (name/date):** Laura Kumar 12/5/87
Title/Purpose: Proc/Anal of Metals Train	
Continued from:	**Continued to:**
Witnessed by:	**Entered by:** LK
	Verified by:
Witnessed by:	**Reviewed by:**
	Validated by:
(signature/date)	(initials/date) (initials/date)

MERC 8910L02-12 12001
proc/BL TR #2 PM RIN AC
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 12002
proc/BL TR #2 PM RIN NI
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

no sample 12003
no cyclone catch

Comb w/12005, 12006 resp

MERC 8910L02-12 12004
proc/BL TR #2 PM FILTER
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 12005
proc/BL TR #2 PM FR HLF AC
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 12006
proc/BL TR #2 PM FR HLF NI
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 12007
proc/BL TR #2 PM BCK HALF
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 12008
proc/BL TR #2 PM KMnO4
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 12009
proc/BL TR #2 PM CAUSTIC
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MRI Project No.: 8910(01 12) **Performed by (name/date):** Laura Kinner 12/5/87

Title/Purpose: Prob/ rinse of Metals Train

Continued from: **Continued to:** **Entered by:** SK **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 13001
Prob/ BL TR #3 PM RIN AC
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 13002
Prob/ BL TR #3 PM RIN NI
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

Comb w/13005, 13006 resp.

NO Sample 13003 NO Cyclone Catch

MERC 8910L02-12 13004
Prob/ BL TR #3 PM FILTER
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 13005
Prob/ BL TR #3 PM FR HLF AC
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 13006
Prob/ BL TR #3 PM FR HLF NI
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 13007
Prob/ BL TR #3 PM BCK HALF
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 13008
Prob/ BL TR #3 PM KMnO4
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 13009
Prob/ BL TR #3 PM CAUSTIC
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

This train was smashed at the ~~Bell~~ Fur at Run 1 start up. The Blds #1 was brought down and weighed for replacement.

MRI Project No.: 8910L02-12 **Performed by (name/date):** Laura Kumer 12/9/87
Title/Purpose: Run I

Continued from: **Continued to:** **Entered by:** **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 1001
P/M PROBE RINSE ACETONE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 1002
P/M PROBE RINSE NITRIC
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 1003
P/M CYCLONE CATCH
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

no catch

yes there was! 01/04/88

MERC 8910L02-12 1004
P/M FILTER
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 1005
P/M FRONT HALF RINSE ACETONE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 1006
P/M FRONT HALF RINSE NITRIC
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 1007
P/M BACK HALF RINSE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 1008
P/M KMnO4 IMPINGER
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 1009
P/M CAUSTIC
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

1285- 20

MRI Project No.: 8910(02-12) **Performed by (name/date):** Laura Kramer 12/9/87

Title/Purpose: Run I

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 **1017**
OUT P/M PR RIN ACETONE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 **1018**
OUT P/M PR RIN NITRIC
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 **1020**
OUT P/M FILTER
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 **1021**
OUT P/M FR HLF RIN ACETONE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 **1022**
OUT P/M FR HLF RIN NITRIC
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 **1023**
OUT P/M BK HLF RINSE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 **1024**
OUT P/M KMnO4 IMPINGER
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 **1025**
OUT P/M CAUSTIC
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MRI Project No.: 8910 (02-12) **Performed by (name/date):** Laura Kinnes 12/10/8

Title/Purpose:

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 **2001**
P/M PROBE RINSE ACETONE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2002**
P/M PROBE RINSE NITRIC
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2003**
P/M CYCLONE CATCH
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2004**
P/M FILTER
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2005**
P/M FRONT HALF RINSE ACETONE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2006**
P/M FRONT HALF RINSE NITRIC
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2007**
P/M BACK HALF RINSE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2008**
P/M KMnO4 IMPINGER
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2009**
P/M CAUSTIC
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MRI Project No.: 8910L02-12	**Performed by (name/date):** 12/10/8		
Title/Purpose:			
Continued from:	**Continued to:**	**Entered by:**	**Verified by:**
Witnessed by:		**Reviewed by:**	**Validated by:**
Witnessed by:			
(signature/date)		(initials/date)	(initials/date)

MERC 8910L02-12 **2017**
OUT P/M FR RIN ACETONE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2018**
OUT P/M FR RIN NITRIC
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2020**
OUT P/M FILTER
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2021**
OUT P/M FR HLF RIN ACETONE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2022**
OUT P/M FR HLF RIN NITRIC
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2023**
OUT P/M BK HLF RINSE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2024**
OUT P/M KMnO4 IMPINGER
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2025**
OUT P/M CAUSTIC
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MRI Project No.: 8910 02-12 Performed by (name/date): Laura Kinner 12/11
Title/Purpose:

Continued from: Continued to: Entered by: Verified by:
Witnessed by: Reviewed by: Validated by:
Witnessed by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 3001
P/M PROBE RINSE ACETONE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

[illegible]
12/15/87

MERC 8910L02-12 3002
P/M PROBE RINSE NITRIC
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 3003
P/M CYCLONE CATCH
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 3004
P/M FILTER
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 3005
P/M FRONT HALF RINSE ACETONE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 3006
P/M FRONT HALF RINSE NITRIC
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 3007
P/M BACK HALF RINSE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 3008
P/M KMnO4 IMPINGER
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 3009
P/M CAUSTIC
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

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MRI Project No.: 8910 02-12 Performed by (name/date): Laura Kinner 12/11/87
Title/Purpose:

Continued from: Continued to: Entered by:
Witnessed by: Verified by:
Witnessed by: Reviewed by: Validated by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 **3017**
OUT P/M PR RIN ACETONE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

This line done on 12/12/87

MERC 8910L02-12 **3018**
OUT P/M PR RIN NITRIC
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 **3020**
OUT P/M FILTER
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 **3021**
OUT P/M FR HLF RIN ACETONE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 **3022**
OUT P/M FR HLF RIN NITRIC
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 **3023**
OUT P/M BK HLF RINSE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 **3024**
OUT P/M KMnO4 IMPINGER
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 **3025**
OUT P/M CAUSTIC
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler:

MRI Project No.: 8910 L02-12 **Performed by (name/date):** Laura Kinner

Title/Purpose: Run 0 Blks

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) **(initials/date)** **(initials/date)**

MERC 8910L02-12 15004
Run 0 BL TR # 1 PM FILTER
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 15005
Run 0 BL TR # 1 PM FR HLF AC
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 15006
Run 0 BL TR # 1 PM FR HLF NI
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 15007
Run 0 BL TR # 1 PM BCK HALF
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 15008
Run 0 BL TR # 1 PM KMnO4
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 15009
Run 0 BL TR # 1 PM CAUSTIC
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 15001
Run 0 BL TR # 1 PM RIN AC
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 15002
Run 0 BL TR # 1 PM RIN NI
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MRI Project No.: 8910 (02-12) **Performed by (name/date):** Laura Kramer 12/9/87

Title/Purpose: Run II BLK Metals

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) **(initials/date)** **(initials/date)**

MERC 8910L02-12 **16001**
Run BL TR #1 PM RIN AC
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

MERC 8910L02-12 **16002**
Run BL TR #1 PM RIN NI
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

MERC 8910L02-12 **16004**
Run BL TR #1 PM FILTER
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

MERC 8910L02-12 **16005**
Run BL TR #1 PM FR HLF AC
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

MERC 8910L02-12 **16006**
Run BL TR #1 PM FR HLF NI
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

MERC 8910L02-12 **16007**
Run BL TR #1 PM BCK HALF
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

MERC 8910L02-12 **16008**
Run BL TR #1 PM KMnO4
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

MERC 8910L02-12 **16009**
Run BL TR #1 PM CAUSTIC
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

MRI Project No.: 8910L0212 **Performed by (name/date):** Laura Kinner 7/8/8
Title/Purpose: Blanks metals

Continued from: **Continued to:** **Entered by:** LRK **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 1059
BLANK HNO3/H2O2
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1060
BLANK HNO3
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1061
BLANK KMnO4
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1062
BLANK WATER (metals)
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1063
BLANK ACETONE (metals)
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1064
BLANK FILTER (metals)
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1065
BLANK BOTTLE (metals)
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1066
BLANK BOTTLE (metals)
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1070
BLANK CAUSTIC
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MRI Project No.: 8910 02-12 **Performed by (name/date):** Laura Kunner 12/14

Title/Purpose: post Rinse

Continued from: **Continued to:** **Entered by:** LK **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 18001
post BL TR # 3 PM RIN AC
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 18002
post BL TR # 3 PM RIN NI
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 18004
post BL TR # 3 PM FILTER
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 18005
post BL TR # 3 PM FR HLF AC
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 18006
post BL TR # 3 PM FR HLF NI
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 18007
post BL TR # 3 PM BCK HALF
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 18008
post BL TR # 3 PM KMnO4
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 18009
post BL TR # 3 PM CAUSTIC
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

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MRI Project No.: 8910 02-12	**Performed by (name/date):** 12/14/87		
Title/Purpose:			
Continued from:	**Continued to:**	**Entered by:** SK	**Verified by:**
Witnessed by:		**Reviewed by:**	**Validated by:**
Witnessed by:			
(signature/date)		(initials/date)	(initials/date)

MERC 8910L02-12 17001
post BL TR # 2 PM RIN AC
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 17002
post BL TR # 2 PM RIN NI
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 17004
post BL TR # 2 PM FILTER
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 17005
post BL TR # 2 PM FR HLF AC
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 17006
post BL TR # 2 PM FR HLF NI
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 17007
post BL TR # 2 PM BCK HALF
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 17008
post BL TR # 2 PM KMnO4
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 17009
post BL TR # 2 PM CAUSTIC
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

K.5 Field Laboratory and Sample Identification Log - Semivolatile Organics

MRI Project No.: 8910 (01-12)	**Performed by (name/date):** Laura Kinner 12/4/87		
Title/Purpose: Reagent Preparation for SMV Trains			
Continued from:	**Continued to:**	**Entered by:** LRK	**Verified by:**
Witnessed by:		**Reviewed by:**	**Validated by:**
Witnessed by:			
	(signature/date)	(initials/date)	(initials/date)

only DI water in impingers

MRI Project No.: 8910 (01 02) **Performed by (name/date):** Laura Kinnes 12/5/87
Title/Purpose: prod / rinse B / ~~[illegible]~~ SMV Trains

Continued from: **Continued to:** **Entered by:** **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 11012
prod BL TR # 4 SV FILTER
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

no Sample 11011
used pm filter no Catch
and changed in cyclone
to ~~[illegible]~~ SMV filter

MERC 8910L02-12 11013
prod BL TR # 4 SV FRN HALF
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 11014
prod BL TR # 4 SV BCK HALF
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 11015
prod BL TR # 4 SV XAD
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

use this Sample
for XAD Blank

MERC 8910L02-12 11016
prod BL TR # 4 SV COND
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MRI Project No.: 8910 (01 12)	**Performed by (name/date):** Laura Kinnes 12/5/87
Title/Purpose: proof rinse of SMV trains	
Continued from:	**Continued to:**
Entered by:	**Verified by:**
Witnessed by:	**Reviewed by:**
Validated by:	
Witnessed by:	
(signature/date)	(initials/date) (initials/date)

MERC 8910L02-12 **12012**
proof BL TR # 5 SV FILTER
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **12013**
proof BL TR # 5 SV FRN HALF
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **12014**
proof BL TR # 5 SV BCK HALF
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **12015**
proof BL TR # 5 SV XAD
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **12016**
proof BL TR # 5 SV COND
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

no sample 12011
xad pm filter and changed to SMV filter
no catch in cyclone

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MRI Project No.: 8910 (0112) **Performed by (name/date):** Laura Kimes 12/5/87

Title/Purpose: prod/ cruise of SmV trains

Continued from: **Continued to:** **Entered by:** LK **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 **13012**
prod/ BL TR # 6 SV FILTER
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

No Sample 13011 no Catch in Cyclone

used PM filter and changed to SMV

MERC 8910L02-12 **13013**
prod/ BL TR # 6 SV FRN HALF
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **13014**
prod/ BL TR # 6 SV BCK HALF
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **13015**
prod/ BL TR # 6 SV XAD
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MERC 8910L02-12 **13016**
prod/ BL TR # 6 SV COND
Dispose of sample 06/01/88
Date: 12/5/87 Time:
Sampler:

MRI Project No.: 8910 (02-12)	**Performed by (name/date):** Laura Kunnes 12/9/87	
Title/Purpose: Run I		
Continued from:	**Continued to:**	
	Entered by:	**Verified by:**
Witnessed by:	**Reviewed by:**	**Validated by:**
Witnessed by:		
(signature/date)	(initials/date)	(initials/date)

MERC 8910L02-12 **1011**
SV CYCLONE CATCH
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 **1012**
SV FILTER
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 **1013**
SV FRONT HALF RINSE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 **1014**
SV BACK HALF RINSE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 **1015**
SV XAD CARTRIDGE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

MERC 8910L02-12 **1016**
SV CONDENSATE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LLK

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MRI Project No.: 8910 (02, 12) **Performed by (name/date):** Laura Kinney 12/9/87
Title/Purpose:

Continued from: **Continued to:** **Entered by:** **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) **(initials/date)** **(initials/date)**

MERC 8910L02-12 **1028**
OUT SV FILTER
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LK

MERC 8910L02-12 **1029**
OUT SV FRONT HALF RINSE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LK

MERC 8910L02-12 **1030**
OUT SV BACK HALF RINSE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LK

MERC 8910L02-12 **1031**
OUT SV XAD CARTRIDGE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LK

MERC 8910L02-12 **1032**
OUT SV CONDENSATE
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler: LK

MRI Project No.: 8910 L02-12 **Performed by (name/date):** Laura Kinner 12/10/8

Title/Purpose:

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 **2011**
SV CYCLONE CATCH
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2012**
SV FILTER
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2013**
SV FRONT HALF RINSE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2014**
SV BACK HALF RINSE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2015**
SV XAD CARTRIDGE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 **2016**
SV CONDENSATE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

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MRI Project No.: 8910 L02-12 **Performed by (name/date):** Laura Kumer 12/10/87
Title/Purpose:

Continued from: **Continued to:** **Entered by:** LLK **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 2027
OUT SV CYCLONE CATCH
~~Dispose of sample 06/01/88~~
Date: 12/10/87 Time:
Sampler: LLK

NO cyclone

MERC 8910L02-12 2028
OUT SV FILTER
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 2029
OUT SV FRONT HALF RINSE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 2030
OUT SV BACK HALF RINSE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 2031
OUT SV XAD CARTRIDGE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

MERC 8910L02-12 2032
OUT SV CONDENSATE
Dispose of sample 06/01/88
Date: 12/10/87 Time:
Sampler: LLK

2 Sample Bottles

MRI Project No.: 8910 02-12 **Performed by (name/date):** Louise Kumer 12/10/8

Title/Purpose:

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 3011
SV CYCLONE CATCH
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 3012
SV FILTER
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 3013
SV FRONT HALF RINSE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 3014
SV BACK HALF RINSE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 3015
SV XAD CARTRIDGE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 3016
SV CONDENSATE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

This Run done on 12/12/87

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MRI Project No.: 8910 02-12 **Performed by (name/date):** Laura Kimmel 12/10/87
Title/Purpose:

Continued from: **Continued to:** **Entered by:** **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 **3028**
OUT SV FILTER
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 **3029**
OUT SV FRONT HALF RINSE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 **3030**
OUT SV BACK HALF RINSE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 **3031**
OUT SV XAD CARTRIDGE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

MERC 8910L02-12 **3032**
OUT SV CONDENSATE
Dispose of sample 06/01/88
Date: 12/11/87 Time:
Sampler: LLK

This Run done by 12/12/87

MRI Project No.: 8910L02-12 **Performed by (name/date):** Laura Kinner 12/8/8

Title/Purpose: Run 0 SMV Blk

Continued from: **Continued to:** **Entered by:** **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 **15010**
Run 0 BL TR # 4 SV PR RINSE
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 **15012**
Run 0 BL TR # 4 SV FILTER
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 **15013**
Run 0 BL TR # 4 SV FRN HALF
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 **15014**
Run 0 BL TR # 4 SV BCK HALF
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 **15015**
Run 0 BL TR # 4 SV XAD
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 **15016**
Run 0 BL TR # 4 SV COND
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

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MRI Project No.: 8910L02-12	**Performed by (name/date):** Sanya Kumer 12/9/87	
Title/Purpose: Run II BLKS SMV		
Continued from:	**Continued to:**	**Entered by:**
Witnessed by:		**Reviewed by:**
Witnessed by:		
(signature/date)	(initials/date)	(initials/date)

Verified by:

Validated by:

MERC 8910L02-12 **16012**
Run BL TR # 4 SV FILTER
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

MERC 8910L02-12 **16013**
Run BL TR # 4 SV FRN HALF
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

MERC 8910L02-12 **16014**
Run BL TR # 4 SV BCK HALF
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

MERC 8910L02-12 **16015**
Run BL TR # 4 SV XAD
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

MERC 8910L02-12 **16016**
Run BL TR # 4 SV COND
Dispose of sample 06/01/88
Date: 12/9/87 Time:
Sampler:

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MRI Project No.: 8910 L02-12 Performed by (name/date): Laura Kinner 12/8/87
Title/Purpose: Blanks SMV

Continued from: Continued to: Entered by: Verified by:
Witnessed by: Reviewed by: Validated by:
Witnessed by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 1049
BLANK ACETONE
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1050
BLANK HEXANE
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1051
BLANK ACETONE/HEXANE
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1052
BLANK WATER
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1054
BLANK FILTER SMV
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1055
BLANK BOTTLE NMAB
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MERC 8910L02-12 1056
BLANK BOTTLE JAR
Dispose of sample 06/01/88
Date: 12/8/87 Time:
Sampler:

MRI Project No.: 8910 L02-12	**Performed by (name/date):** Louisa Kinner 12/14/87		
Title/Purpose:			
Continued from:	**Continued to:**	**Entered by:**	**Verified by:**
Witnessed by:		**Reviewed by:**	**Validated by:**
Witnessed by:			
	(signature/date)	(initials/date)	(initials/date)

MERC 8910L02-12 17010
post BL TR #5 SV PR RINSE
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 17012
post BL TR #5 SV FILTER
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 17013
post BL TR #5 SV FRN HALF
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 17014
post BL TR #5 SV BCK HALF
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 17015
post BL TR #5 SV XAD
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 17016
post BL TR #5 SV COND
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

1286- 24

MRI Project No.: 8910 C212 **Performed by (name/date):** Laura Kimes 12/14/87
Title/Purpose:

Continued from: **Continued to:** **Entered by:** **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 18012
post BL TR # 6 SV FILTER
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 18013
post BL TR # 6 SV FRN HALF
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 18014
post BL TR # 6 SV BCK HALF
Dispose of sample 06/01/88
Date: 12/14/5 Time:
Sampler:

MERC 8910L02-12 18015
post BL TR # 6 SV XAD
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

MERC 8910L02-12 18016
post BL TR # 6 SV COND
Dispose of sample 06/01/88
Date: 12/14/87 Time:
Sampler:

K.6 Process Sample Identification Log

MRI Project No.: 8910L0212 **Performed by (name/date):** RCN 9DEC87
Title/Purpose: Sample Label Duplicates

Continued from: Begin **Continued to:** 62 **Entered by:** RCN 9DEC87 **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 1033
CYCLONE ASH (METALS)
Dispose of sample 06/01/88
Date: 9DEC87 Time: 16:20 to
Sampler: RCN 18:25

MERC 8910L02-12 1034
CYCLONE ASH (%C,%COMB)
Dispose of sample 06/01/88
Date: 9DEC87 Time: 16:20 to
Sampler: RCN 18:25

MERC 8910L02-12 1035
CYCLONE ASH (ORGANICS)
Dispose of sample 06/01/88
Date: 9DEC87 Time: 16:20 to
Sampler: RCN 18:25

MERC 8910L02-12 1036
FAB FILTER ASH (METALS)
Dispose of sample 06/01/88
Date: 9DEC87 Time: 16:30 to
Sampler: RCN 18:20

MERC 8910L02-12 1037
FAB FILTER ASH (%C,%COMB)
Dispose of sample 06/01/88
Date: 9DEC87 Time: 16:30 to
Sampler: RCN 18:20

MERC 8910L02-12 1038
FAB FILTER ASH (ORGANICS)
Dispose of sample 06/01/88
Date: 9DEC87 Time: 16:30 to
Sampler: RCN 18:20

MERC 8910L02-12 1042
BOTTOM ASH (METALS)
Dispose of sample 06/01/88
Date: 9DEC87 Time: 16:10 to
Sampler: RCN 18:10

MERC 8910L02-12 1043
BOTTOM ASH (%C,%COMB)
Dispose of sample 06/01/88
Date: 9DEC87 Time: 1610 to
Sampler: RCN 1810

MRI Project No.: 8910L0212 **Performed by (name/date):** RCN 9DEC 87
Title/Purpose: Sample label duplicates
Continued from: 61 **Continued to:** End **Entered by:** RCN 9DEC87 **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 1044
BOTTOM ASH (ORGANICS)
Dispose of sample 06/01/88
Date: 9DEC87 Time: 16:10 to 1810
Sampler: RCN

MERC 8910L02-12 1045
RDF
Dispose of sample 06/01/88
Date: 9DEC87 Time: 16:05 to 18:05
Sampler: RCN

One label on this page for RDF Process + RDF Reclaim in 2 fibre drums RDF Reclaim not taken

MERC 8910L02-12 1046
LIME SLURRY (METALS)
Dispose of sample 06/01/88
Date: 9DEC 87 Time: 17:45
Sampler: RCN

[9DEC87 RCN] RDF (beginning) taken at upstream of long conveyor

MERC 8910L02-12 1069
FAB FILTER ASH (RESIST)
Dispose of sample 06/01/88
Date: 9DEC87 Time: 16:30 to 18:30
Sampler: RCN

MERC 8910L02-12 1071
Lime Slurry % Solids
Dispose of sample 06/01/88
Date: 9DEC87 Time: 17:45
Sampler: RCN

MERC 8910L02-12 1072
Lime Slurry Dioxins
Dispose of sample 06/01/88
Date: 9DEC 87 Time: 17:45
Sampler: RCN

MERC 8910L02-12 1073
Fabric Filter Ash (K Factor)
Dispose of sample 06/01/88
Date: 9DEC87 Time: 17:28
Sampler: RCN

1 - 5 gal pail

MERC 8910L02-12 1073
Fabric Filter Ash (K-Factor)
Dispose of sample 06/01/88
Date: 9DEC87 Time: 16:30
Sampler: RCN

1 - 5 gal pail

MRI Project No.: 8910L0212 **Performed by (name/date):** RCN 10DEC87
Title/Purpose: Sample Label Duplicates
Continued from: Beg'n **Continued to:** 64 **Entered by:** RCN 10DEC87 **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 2033
CYCLONE ASH (METALS)
Dispose of sample 06/01/88
Date: 10DEC87 Time: 13:52 to
Sampler: RCN 18:25

MERC 8910L02-12 2034
CYCLONE ASH (%C,%COMB)
Dispose of sample 06/01/88
Date: 10DEC87 Time: 13:52 to
Sampler: RCN 18:25

MERC 8910L02-12 2035
CYCLONE ASH (ORGANICS)
Dispose of sample 06/01/88
Date: 10DEC87 Time: 13:52 to
Sampler: RCN 18:25

MERC 8910L02-12 2036
FAB FILTER ASH (METALS)
Dispose of sample 06/01/88
Date: 10DEC87 Time: 13:40 to
Sampler: RCN 18:30

MERC 8910L02-12 2037
FAB FILTER ASH (%C,%COMB)
Dispose of sample 06/01/88
Date: 10DEC87 Time: 13:40 to
Sampler: RCN 18:30

MERC 8910L02-12 2038
FAB FILTER ASH (ORGANICS)
Dispose of sample 06/01/88
Date: 10DEC87 Time: 13:40 to
Sampler: RCN 18:30

MERC 8910L02-12 2042
BOTTOM ASH (METALS)
Dispose of sample 06/01/88
Date: 10DEC87 Time: 13:35 to
Sampler: RCN 16:30

MERC 8910L02-12 2043
BOTTOM ASH (%C,%COMB)
Dispose of sample 06/01/88
Date: 10DEC87 Time: 13:35 to
Sampler: RCN 16:30

MRI Project No.: 8910L0212 **Performed by (name/date):** RCN 10DEC87

Title/Purpose: Sample Label Duplicates

Continued from: 63 **Continued to:** End **Entered by:** RCN 10DEC87 **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 2044
BOTTOM ASH (ORGANICS)
Dispose of sample 06/01/88
Date: 10DEC87 Time: 13:35 to 16:30
Sampler: RCN

MERC 8910L02-12 2045
RDF
Dispose of sample 06/01/88
Date: 16:55 Time: 13:30
Sampler: BDM from B&W

B&W = Babcock + Wilcox
Samples from feed ram

MERC 8910L02-12 2046
LIME SLURRY (METALS)
Dispose of sample 06/01/88
Date: 10DEC87 Time: 15:55
Sampler: RCN

MERC 8910L02-12 2069
FAB FILTER ASH (RESIST)
Dispose of sample 06/01/88
Date: 10DEC87 Time: 13:40 to 18:30
Sampler: RCN

MERC 8910L02-12 2071
Lime Slurry % Solids
Dispose of sample 06/01/88
Date: 10DEC87 Time: 15:55
Sampler: RCN

MERC 8910L02-12 2072
Lime Slurry Dioxins
Dispose of sample 06/01/88
Date: 10DEC87 Time: 15:55
Sampler: RCN

MERC 8910L02-12 [illegible]
Fab Filter Ash (K-factor)
Dispose of sample 06/01/88
Date: 14:23 Time: 10DEC87
Sampler: RCN

MERC 8910L02-12 [illegible]
Fab Filter Ash (K-Factor)
Dispose of sample 06/01/88
Date: 10DEC87 Time: 16:35
Sampler: RCN

MRI Project No.: 8910L0212 **Performed by (name/date):** RCN 12DEC87

Title/Purpose: Sample Label Duplicates

Continued from: Begin **Continued to:** 66 **Entered by:** RCN 12DEC87 **Verified by:**

Witnessed by: **Reviewed by:** **Validated by:**

Witnessed by:

(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 3033
CYCLONE ASH (METALS)
Dispose of sample 06/01/88
Date: 12DEC87 Time: 13:10 to 18:35
Sampler: RCN

MERC 8910L02-12 3034
CYCLONE ASH (%C,%COMB)
Dispose of sample 06/01/88
Date: 12DEC87 Time: 13:10 to 18:35
Sampler: RCN

MERC 8910L02-12 3035
CYCLONE ASH (ORGANICS)
Dispose of sample 06/01/88
Date: 12DEC87 Time: 13:10 to 18:35
Sampler: RCN

Cyclone Ash Samples were obtained from a composite collected 13:10 to 18:35. Very little sample was available, all sample was split & placed into the corresponding container.

MERC 8910L02-12 3036
FAB FILTER ASH (METALS)
Dispose of sample 06/01/88
Date: 12DEC87 Time: 13:10 to 18:30
Sampler: RCN

MERC 8910L02-12 3037
FAB FILTER ASH (%C,%COMB)
Dispose of sample 06/01/88
Date: 12DEC87 Time: 13:40 18:30
Sampler: RCN

MERC 8910L02-12 3038
FAB FILTER ASH (ORGANICS)
Dispose of sample 06/01/88
Date: 12DEC87 Time: 13:10 to 18:30
Sampler: RCN

MERC 8910L02-12 3042
BOTTOM ASH (METALS)
Dispose of sample 06/01/88
Date: 12DEC87 Time:
Sampler: RCN

Not taken

MERC 8910L02-12 3043
BOTTOM ASH (%C,%COMB)
Dispose of sample 06/01/88
Date: 12DEC87 Time:
Sampler: RCN

Not taken

Bottom Ash was not taken Project monitor, G. Reiley, decided not to take these samples as the plant was having problems.

MRI Project No.: 8910262L2 **Performed by (name/date):** RCN 12DEC87
Title/Purpose: Sample Label Duplicates

Continued from: 65 **Continued to:** End **Entered by:** RQV 12 DEC 87 **Verified by:**
Witnessed by: **Reviewed by:** **Validated by:**
Witnessed by:
(signature/date) (initials/date) (initials/date)

MERC 8910L02-12 3044
BOTTOM ASH (ORGANICS)
Dispose of sample 06/01/88
Date: 12 DEC 87 Time:
Sampler: RCN

—Not taken

MERC 8910L02-12 3045
RDF
Dispose of sample 06/01/88
Date: 12 DEC 87 Time: 13:00 to 14:50
Sampler: RCN

MERC 8910L02-12 3046
LIME SLURRY (METALS)
Dispose of sample 06/01/88
Date: 12 DEC 87 Time: 14:45
Sampler: RCN

MERC 8910L02-12 3069
FAB FILTER ASH (RESIST)
Dispose of sample 06/01/88
Date: 12 DEC 87 Time: 13:10 to 18:30
Sampler: RCN

MERC 8910L02-12 3071
Lime Slurry % Solids
Dispose of sample 06/01/88
Date: 12 DEC 87 Time: 14:45
Sampler: RCN

MERC 8910L02-12 3072
Lime Slurry Dioxins
Dispose of sample 06/01/88
Date: 12 DEC 87 Time: 14:45
Sampler: RCN

MERC 8910L02-12 3073
Fab Filter Ash K-factor
Dispose of sample 06/01/88
Date: 12 DEC 87 Time: 13:00
Sampler: RCN

MERC 8910L02-12 3073
Fab Filter Ash K-factor
Dispose of sample 06/01/88
Date: 12 DEC 87 Time: 15:00
Sampler: RCN

K.7 Field Sample Traceability Logs

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 8910 (02 12)
④ Date of Field Sampling 12-9-87
⑤ Location MERC
⑥ Type of Sample M5/MM5 Inlet
⑦ Container No.
⑧ Storage Requirements ice

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check				⑭ Comments
1001	Probe Ace	Inlet	Kinnes	✓	✓	✓		
1002	" HNO3	rinse		✓	✓		✓	
1003	Cyclone			✓	✓	✓		
1004	Filter			✓	✓	✓		
1005	Front ½	Ace		✓	✓	✓		
1006	" "	HNO3		✓	✓		✓	
1007	Back ½			✓	✓		✓	
1008	Kmmy			✓	✓		✓	
~~1009 ELK~~	~~Cyclone~~	SM ✓						
1011	~~Filter~~ Cyclone			✓	✓			
1012	~~Front ½~~ Filter			✓	✓	✓		
1013	~~Back ½~~ Front ½			✓	✓	✓		
1014	Back ½			✓	✓	✓		
1015	XAD			✓	✓	✓		
1016	Condensate			✓	✓			
~~1017 ELK~~								
~~1018 ELK~~								

⑮ Date 12-10-87 SWK

⑯ Seal Intact											
⑰ Date											
⑱ Checked by (Initials)											

⑲ Relinquished by	S. Kinnes			
⑳ Date	12-21-87	1-4-88	1-4-88	
㉑ Time	4:00pm	3:30pm	3:50pm	
㉒ Received by			E.M. Clinton	

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 8910 (02-12)
④ Date of Field Sampling 12-5-87
⑤ Location MERC
⑥ Type of Sample Hs/mms Outlet
⑦ Container No.
⑧ Storage Requirements ice

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
1017	probe Ace	metals outlet	Kinner	✓✓✓	
1018	" HNO3			✓✓ ✓	
1020	filter			✓✓✓	
1021	front ½	Ace		✓✓✓	
1022	" "	HNO3		✓✓ ✓	
1023	Back ½			✓✓ ✓	
1024	KMnO4			✓✓ ✓	
1028	filter	SMK out		✓✓	
1029	front ½			✓✓	
1030	Back ½			✓✓	
1031	XAD			✓✓	
1032	Cond			✓✓	

⑮ Date 12-10-87 1/4 SRK

⑯ Seal Intact											
⑰ Date											
⑱ Checked by (Initials)											

⑲ Relinquished by	Kinner			
⑳ Date	12-21-87	1-4-88	1-4-88	
㉑ Time	4:00pm	3:00pm	3:50pm	
㉒ Received by			EM McClendon	

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 8910L0212
④ Date of Field Sampling 9 DEC 87
⑤ Location MERC
⑥ Type of Sample Grab
⑦ Container No.
⑧ Storage Requirements 4°C

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
1044	Bottom Ash	Organics	RCN	✓ ✓	
1043	" "	% C	↓	✓ ✓	
1042	" "	Metals		✓ ✓ ✓	
1034	Cyclone Ash	% C		✓ ✓	
1033	" "	Metals		✓ ✓ ✓	
1035	" "	Organics		✓ ✓	
1046	Lime Slurry	Metals		✓ ✓ ✓	
1071	" "	% Solids		✓ ✓	
1072	" "	Dioxins		✓ ✓	
1038	Baghouse	Organics		✓ ✓	
1037	"	% C		✓ ✓	
1036	"	Metals		✓ ✓ ✓	
1069	"	Resistivity	↓	✓ ✓	

⑮ Date RCN ✓ [illegible]
4 Dec 87 SWK

⑯ Seal Intact												
⑰ Date												
⑱ Checked by (Initials)	SWK											

⑲ Relinquished by	S. Klemm			
⑳ Date	12/21/87	12-23-87		
㉑ Time	4:00pm	5:00pm		
㉒ Received by		McClendon		

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
③ Project Number 8910L0212
⑤ Location MBRC
⑦ Container No. 1045

② ☒ Traceability Log
④ Date of Field Sampling 9 DEC 87
⑥ Type of Sample Trash Bags (Grab) RDF
⑧ Storage Requirements 4°C Keep Bagged for Moisture

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/Level/Check	⑭ Comments
1045	Double Bagged		RCN	/	
	Garbage	Sacks			
	Containing	RDF			

⑮ Date 9 Dec 87

⑯ Seal Intact												
⑰ Date												
⑱ Checked by (Initials)												

⑲ Relinquished by				
⑳ Date				
㉑ Time				
㉒ Received by				

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☑ Traceability Log
③ Project Number 8960L0217
④ Date of Field Sampling 9DEC 87
⑤ Location MBRC
⑥ Type of Sample Grab in 2-5 gal pails
⑦ Container No. 1073
⑧ Storage Requirements ~~Keep Bagged for moisture~~ None

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
1073	Seal Pail		RCN	/ /	K-factor
1073	Seal Pail		RCN	/	K-factor
	Baghouse				

⑮ Date 9 Dec 87

⑯ Seal Intact												
⑰ Date												
⑱ Checked by (Initials)												

⑲ Relinquished by				
⑳ Date				
㉑ Time				
㉒ Received by				

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☑ Traceability Log
③ Project Number 8910 102-12
④ Date of Field Sampling 12-8-87
⑤ Location MERC
⑥ Type of Sample MMS/MS Blank)
⑦ Container No.
⑧ Storage Requirements Ice

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⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
1059	HNO3/H2O2 Bl			✓✓	
1060	HNO3 Bl			✓✓	
1061	KMnO4 Bl			✓✓	
~~1062~~ ILK	~~Bl H2O~~			✓	
1063	Bl Ace			✓✓✓	
1064	Bl filter			✓✓	
~~1065~~	~~Bottle Blank~~				
✓ 1066	Bl Bottle			✓✓	
1049	Bl Ace			✓✓	
1050	Bl Hex			✓✓	
1051	Ace/Hex Bl			✓✓	
1052	Bl H2O			✓✓	
✓ 1054	SMV filter Bl			✓✓	
✓ 1055	Bl Bottle			✓✓	
1056	Bl gas			✓✓	

⑮ Date 12-8-87 SWK

⑯ Seal Intact
⑰ Date
⑱ Checked by (Initials)

⑲ Relinquished by	S. Killman			
⑳ Date	12/21/87	1-4-88		
㉑ Time	4:00pm	3:00 pm		
㉒ Received by				

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 8910 602-12
④ Date of Field Sampling 12/10/87
⑤ Location MERC
⑥ Type of Sample MS/MMS inlet
⑦ Container No.
⑧ Storage Requirements ice

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check				⑭ Comments
2011	Cyclone	SM ✓	Kinnes	✓	✓			
2012	filter			✓	✓			
2013	front 1/2			✓	✓			
2014	Back 1/2			✓	✓			UK
2015	XAD			✓	✓			~~2 samples~~
2016	Condensate	↓		✓	✓			
2001	probe Acl metals			✓	✓	✓		
2002	" HNO3			✓	✓		✓	
2003	Cyclone			✓	✓	✓		
2004	filter			✓	✓	✓		
2005	front 1/2 Acl			✓	✓	✓		
2006	" " HNO3			✓	✓		✓	
2007	Back 1/2			✓	✓		✓	
2008	KMnO4	↓	↓	✓	✓		✓	

⑮ Date 12-10-87 | ✓ | 1/4 | 1/4 SMK

⑯ Seal Intact												
⑰ Date												
⑱ Checked by (Initials)												

⑲ Relinquished by	Kinnes S. Kleeman			
⑳ Date	12-21-87	1-4-88	1-4-88	
㉑ Time	4:00pm	3:00PM	3:50pm	
㉒ Received by	Sautol		E.M. Kleeman	

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 8910 62-12
④ Date of Field Sampling 12/10/87
⑤ Location MERC
⑥ Type of Sample M5/MM5 outlet
⑦ Container No.
⑧ Storage Requirements ice

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
2017	Probe Ace	metals	Kinner	✓ ✓ ✓	
2018	" HNO3	↓	↓	✓ ✓ ✓	
2020	filter			✓ ✓ ✓	
2021	front 1/2 Ace			✓ ✓ ✓	
2022	" HNO3			✓ ✓ ✓	
2023	Back 1/2			✓ ✓ ✓	
2024	KMnO4	↓	↓	✓ ✓ ✓	
~~2027~~ LCK					
2028	filter	SM ✓		✓ ✓	
2029	front 1/2			✓ ✓	
2030	Back 1/2			✓ ✓	
2031	XAD			✓ ✓	2 Samples
2032	Condensate	↓ ✓		✓ ✓	2 Samples

⑮ Date 12-10-87 SWK

⑯ Seal Intact												
⑰ Date												
⑱ Checked by (Initials)												

⑲ Relinquished by	Kinner S Kleen			
⑳ Date	12-21-87	1-4-88	1-4-88	
㉑ Time	4:00pm	3:08 PM	3:50pm	
㉒ Received by	N Burton			

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 0960L0212
④ Date of Field Sampling 10DEC87
⑤ Location MBRC
⑥ Type of Sample Grab Composite
⑦ Container No.
⑧ Storage Requirements 4°C

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
2033	Cyclone Ash	Metals	RCa	/ ✓ ✓	
2034	" "	%C		/ ✓	
2035	" "	Org		/ ✓	
2036	Fab Filter Ash	Metals		/ ✓ ✓	
2037	" "	%C		/ ✓	
2038	" "	Org		/ ✓	
2042	Bottom Ash	Metals		/ ✓ ✓	
2043	" "	%C		/ ✓	
2044	" "	Organics		/ ✓	
2046	Lime Slurry	Metals		/ ✓ ✓	
2071	" "	% Solids		/ ✓	
2072	" "	~~%C~~ Raw		/ ✓	Dioxins
2069	Fab Filter Ash	Resist		/ ✓	

⑮ Date ✓ 12/23

10DEC87 SWK

⑯ Seal Intact	/										
⑰ Date											
⑱ Checked by (Initials)	SWK										

⑲ Relinquished by	S Klamm			
⑳ Date	12/21/87	12-23-87		
㉑ Time	4:00pm	5:00pm		
㉒ Received by		SM Glendon		

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record

② ☒ Traceability Log

( ) Project Number 8910L0212

④ Date of Field Sampling 10DEC87

⑤ Location NERC

⑥ Type of Sample Composite Grab

⑦ Container No.

⑧ Storage Requirements 4°C

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
2045	RDF		RCN	/	Fibre Drum

⑮ Date / 10DEC87

⑯ Seal Intact												
⑰ Date												
⑱ Checked by (Initials)												

⑲ Relinquished by				
⑳ Date				
㉑ Time				
㉒ Received by				

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
Project Number 891010212
⑤ Location MBRC
⑦ Container No.

② ☒ Traceability Log
④ Date of Field Sampling 10DEC87
⑥ Type of Sample Grab
⑧ Storage Requirements Keep Dry

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
2073	Ed Filter Ash		RCW	/	K-factor
2073	" "	"	RCW	/	K factor
					same #
					different times

⑮ Date 10DEC87

⑯ Seal Intact
⑰ Date
⑱ Checked by (Initials)

⑲ Relinquished by
⑳ Date
㉑ Time
㉒ Received by

✓

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 8910 02-12
④ Date of Field Sampling ~~12-11-87~~ 12/12/87
⑤ Location MERC
⑥ Type of Sample MS/MMS [illegible]
⑦ Container No.
⑧ Storage Requirements ICE

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
3001	Probe Ace	metals	Kinner	✓ ✓ ✓	
3002	" HNO3			✓ ✓ ✓	
3003	Cyclone			✓ ✓ ✓	
3004	Filter			✓ ✓ ✓	
3005	front ½ Ace			✓ ✓ ✓	
3006	" " HNO3			✓ ✓ ✓	
3007	Back ½			✓ ✓ ✓	
3008	Condensate	✓		✓ ✓ ✓	
3011	Cyclone SMV	✓		✓ ✓	
3012	Filter			✓ ✓	
3013	front ½			✓ ✓	
3014	BACK ½			✓ ✓	
3015	XAD		✓	✓ ✓	
3016	Condensate	✓	✓	✓ ✓	

⑮ Date 1/4 12/13/87 SWK

⑯ Seal Intact											
⑰ Date											
⑱ Checked by (Initials)											

⑲ Relinquished by	Kinner	Klemm		
⑳ Date	12-21-87	1-4-88	1-4-88	
㉑ Time	4:00pm	3:00 PM	3:00 pm	
㉒ Received by	Sautor	[illegible]	T.M. McClendon	

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 8910 02-12
④ Date of Field Sampling ~~12-11-87~~ 12-12-87 UK
⑤ Location MERC
⑥ Type of Sample M5/MM5 outlet
⑦ Container No.
⑧ Storage Requirements ice

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
3017	probe Ace	metals	Kuner	✓ ✓ ✓	
3018	" HNO3			✓ ✓ ✓	
3020	filter			✓ ✓ ✓	
3021	front ½ Ace			✓ ✓ ✓	
3022	" " HNO3			✓ ✓ ✓	
3023	~~BACK ½~~ KMnO4			✓ ✓ ✓	
3024	BACK ½			✓ ✓ ✓	
3028	filter	Sm ✓		✓ ✓	
3029	front ½			✓ ✓	
3030	Back ½			✓ ✓	
3031	XAD			✓ ✓	
3032	Condensate			✓ ✓	

⑮ Date 1/4 1/4
12-12-87 SWK

⑯ Seal Intact
⑰ Date
⑱ Checked by (Initials)

⑲ Relinquished by	Kuner	J. Hoover		
⑳ Date	12-21-87	1-4-88	1-4-88	
㉑ Time	4:00pm	3:00 pm	3:50pm	
㉒ Received by	N Sautor	J. Hoover	E McKinder	

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☐ Traceability Log
③ Project Number 89606021Z
④ Date of Field Sampling 12 DEC 87
⑤ Location MERC
⑥ Type of Sample Grab - Composite
⑦ Container No.
⑧ Storage Requirements 4°C

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
3069	Baghouse	Resistivity RC		✓	
3038	"	Organics		✓	
3037	"	%C		✓	
3036	"	Metals		✓ ✓	
3046	Lime Slurry	Metals		✓ ✓	
3672	" "	Dioxins		✓	
3071	" "	% Solids		✓	
3033	Cyclone A.	Metals		✓ ✓	
3034	" "	%C		✓	
3035	" "	Organics		✓	

⑮ Date 12/23 12 DEC 87 SWK

⑯ Seal Intact	Y											
⑰ Date												
⑱ Checked by (Initials)	SWK											

⑲ Relinquished by	Sillmm			
⑳ Date	12/21/87	12-23-87		
㉑ Time	4:00pm	5:00pm		
㉒ Received by		EMcClendon		

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☑ Traceability Log
③ Project Number 841020212
④ Date of Field Sampling 12 DEC 87
⑤ Location MERC
⑥ Type of Sample RDF
⑦ Container No.
⑧ Storage Requirements Keep Dry

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
3045	Fiber Drum		RCN	✓	
	of Refuse				
	Derived Fuel				

⑮ Date 12 DEC 87

⑯ Seal Intact												
⑰ Date												
⑱ Checked by (Initials)												

⑲ Relinquished by				
⑳ Date				
㉑ Time				
㉒ Received by				

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☑ Traceability Log
③ Project Number M10L0212
④ Date of Field Sampling 12 DEC 87
⑤ Location MERC
⑥ Type of Sample 5 gal CAN
⑦ Container No.
⑧ Storage Requirements Keep Dry

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
3073	Baghouse				
3073	K-factor				
	2-5gal pails				
	each w/ same				
	Sample #				

⑮ Date 12 DEC 87

⑯ Seal Intact												
⑰ Date												
⑱ Checked by (Initials)												

⑲ Relinquished by				
⑳ Date				
㉑ Time				
㉒ Received by				

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 8910 602-12
④ Date of Field Sampling 12/5/87
⑤ Location MERC
⑥ Type of Sample M5 / PM
⑦ Container No.
⑧ Storage Requirements / ICE

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
11001	~~[illegible]~~ Ace probe rinse			✓	These samples
11002	nitric probe rinse			✓	were combined
11004	filter			✓ ✓	✓ for prob rinse
11005	front 1/2 Ace			✓ ✓ ✓	w/ front 1/2 rinse
11006	" "	HNO3		✓ ✓	✓ Same for
11007	BACK 1/2			✓ ✓	✓ Samples
11008	Kmno4			✓ ✓	✓ 12001
12001	probe rinse ACE			✓	12002
12002	" "	HNO3		✓	13001
12004	filter			✓ ✓	13002
12005	front 1/2 Ace			✓ ✓	
12006	" "	HNO3		✓ ✓	
12007	BACK 1/2			✓ ✓	
12008	Kmno4			✓ ✓	
13001	probe rinse ACE			✓	
13002	" "	HNO3		✓	
13004	filter			✓ ✓	
13005	front 1/2 Ace			✓ ✓	
13006	" "	HNO3		✓ ✓	
13007	Back 1/2			✓ ✓	
13008	Kmno4			✓ ✓	

⑮ Date ✓ ✓ 1/11 1/4
12-7-87

⑯ Seal Intact												
⑰ Date												
⑱ Checked by (Initials)												

⑲ Relinquished by	S. Marin			
⑳ Date	12/21/87	1-11-88	1-4-88	
㉑ Time	4:00pm	10:00 AM	3:50 pm	
㉒ Received by			G McCandless	

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 8910 L0242
④ Date of Field Sampling 12/5/87
⑤ Location MERC
⑥ Type of Sample mms
⑦ Container No. -
⑧ Storage Requirements Ice

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
11012	filter		Kunes	✓ ✓	
11013	Front 1/2			✓ ✓	
11014	Back 1/2			✓ ✓	
11015	XAD			✓ ✓	
11016	Condensate			✓ ✓	
12012	filter			✓ ✓	
12013	Front 1/2			✓ ✓	
12014	Back 1/2			✓ ✓	
12015	XAD			✓ ✓	
12016	Condensate			✓ ✓	
13012	filter			✓ ✓	
13013	Front 1/2			✓ ✓	
13014	Back 1/2			✓ ✓	
13015	XAD			✓ ✓	
13016	Condensate			✓	

⑮ Date 12-7-87 SWK

⑯ Seal Intact											
⑰ Date											
⑱ Checked by (Initials)											

S. Klamm

⑲ Relinquished by	Kunes			
⑳ Date	12/21/87			
㉑ Time	4:00pm			
㉒ Received by	[illegible]			

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☑ Traceability Log
③ Project Number 8910 L02-12
④ Date of Field Sampling 12-8-87
⑤ Location MERC
⑥ Type of Sample MS/MMS
⑦ Container No.
⑧ Storage Requirements Ice

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
14004	filter	1	Kinner	✓✓	
14005	Front ½ Acl			✓✓	Only train Components
14006	" " HNO3			✓✓	" " "
14007	Back ½			✓✓	
14008	Kmno4			✓✓	
~~14009~~ CHS	~~Caustic~~				
15001	Probe Acl	Blts	Run 0	✓✓	
15002	" HNO3			✓✓	
15004	filter			✓✓	
15005	Front ½ Acl			✓✓	
15006	" " HNO3			✓✓	
15007	Back ½			✓✓	
15008	Kmno4			✓✓	
~~15009~~ JLK	~~Caustic~~				
~~15010~~ JLK					
15012	filter	SMV	Blts	✓✓	
15013	Front ½			✓✓	
15014	Back ½			✓✓	
15015	KAN			✓✓	
15016	Cond			✓✓	

⑮ Date 12-8-87 SWK

⑯ Seal Intact
⑰ Date
⑱ Checked by (Initials)

⑲ Relinquished by	Kinner		
⑳ Date	2-21-87		
㉑ Time	4:00pm		
㉒ Received by			

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
③ Project Number 8910 (ale)
⑤ Location MERC
⑦ Container No.

② ☒ Traceability Log
④ Date of Field Sampling 10/9/87
⑥ Type of Sample ms/mms
⑧ Storage Requirements ICE

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
16001	probe Ace	Metal		✓ ✓ ✓	
16002	" HNO3			✓ ✓ ✓ ✓	
16004	filter			✓ ✓ ✓	
16005	Front ½	Ace		✓ ✓ ✓	
16006	" "	HNO3		✓ ✓ ✓	
16007	Back ½			✓ ✓ ✓	
16008	Kmno4			✓ ✓ ✓	
~~16009~~ WK	~~[illegible]~~	✓			
16012	filter	SM ✓		✓ ✓ ✓	
16013	Front ½			✓ ✓	
16014	Back ½			✓ ✓	
16015	XAD			✓ ✓	
1601[illegible]	Cond.	✓		✓ ✓	

⑮ Date [illegible]10-87 SNK

⑯ Seal Intact												
⑰ Date												
⑱ Checked by (Initials)												

⑲ Relinquished by	Kunner			
⑳ Date	12/21/87	1-11-88	1-4-88	
㉑ Time	4:00pm	10:00 am	3:50 pm	
㉒ Received by	Sauter		[illegible]	

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 8910 00-12
④ Date of Field Sampling 12-14-87
⑤ Location MERC
⑥ Type of Sample Post Bcts Outlet
⑦ Container No.
⑧ Storage Requirements Ice

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check	⑭ Comments
17001	probe Acl			✓✓	
17002	" HNO3			✓✓	
17004	filter			✓✓	
17005	front 1/2 Acl			✓✓	
17006	" " HNO3			✓✓	
17007	Back 1/2			✓✓	
17008	Cond.			✓✓	
17012	filter			✓✓	
17013	front 1/2			✓✓	
17014	Back 1/2			✓✓	
17015	XAD			✓✓✓	
17016	Cond			✓✓	

⑮ Date 12-14-87 SNK

⑯ Seal Intact											
⑰ Date											
⑱ Checked by (Initials)											

⑲ Relinquished by			
⑳ Date	12/21/87		
㉑ Time	4:00pm		
㉒ Received by			

(See Back of Page for Explanation of Numbers) ✓

CHAIN OF COUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 8910 02-12
④ Date of Field Sampling 12-14-87
⑤ Location MERC
⑥ Type of Sample ~~Post~~ Beds Outlet
⑦ Container No.
⑧ Storage Requirements Ice

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check				⑭ Comments
18001	probe HCl			✓	✓	✓		
18002	" HNO3			✓	✓	✓		
18004	filter			✓	✓		✓	
18005	front 1/2 HCl			✓	✓	✓		
18006	" HNO3			✓	✓		✓	
18007	Back 1/2			✓	✓		✓	
18008	KMnO4			✓	✓		✓	
~~18009~~								
18012	filter			✓	✓			
18013	front 1/2			✓	✓			
18014	Back 1/2			✓	✓			
18015	XAD			✓	✓			
18016	Cond.			✓	✓			

⑮ Date 12-14-8 SWK

⑯ Seal Intact												
⑰ Date												
⑱ Checked by (Initials)												

S. Flynn

⑲ Relinquished by	[illegible]			
⑳ Date	12/21/87	1-11-88	1-4-88	
㉑ Time	4:00pm	10:00 AM	3:30p	
㉒ Received by	N. Foster	[illegible]	McClendon	

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

① ☐ Chain of Custody Record
② ☒ Traceability Log
③ Project Number 8910 L0212
④ Date of Field Sampling 12-8-87
⑤ Location MERC
⑥ Type of Sample AUDit SAMPles
⑦ Container No.
⑧ Storage Requirements ICE

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check				⑭ Comments
F-130	EPA AUDit SAMPlE			✓	✓			Dioxin
F-176	" "	"		✓	✓			"
F-145	" "	"		✓	✓			"
BOX	BOX OF Filters + AmPules			✓				not in cooler — given to metals
	For EPA Audit							previously.

⑮ Date 12-8-87 SWK

⑯ Seal Intact												
⑰ Date												
⑱ Checked by (Initials)												

⑲ Relinquished by				
⑳ Date	12-21-87			
㉑ Time	4:00pm			
㉒ Received by				

(See Back of Page for Explanation of Numbers)

CHAIN OF CUSTODY OR TRACEABILITY RECORD

( ) ☐ Chain of Custody Record
③ Project Number 8910 L02-12
⑤ Location MERC
⑦ Container No.
② ☐ Traceability Log
④ Date of Field Sampling (12-5-12)
⑥ Type of Sample Caustic Imp MS
⑧ Storage Requirements

⑨ Sample No.	⑩ Description	⑪ Other Ident.	⑫ Sampler	⑬ Inventory/ Level Check				⑭ Comments
11009	Caustic	001	Kinner	✓				
12009				✓				
13009				✓				
14009				✓				
10062	Bl Hg metals			✓				
10070	Bl Caustic			✓				
15009	Bl & Caustic			✓				
10065	Bl Bottle			✓				
16009	Bl Caustic			✓				
1009				✓				
1025				✓				
2009				✓				
2025				✓				
3009				✓				
3025				✓				
17009				✓				
18009				✓				

⑮ Date 1/6

⑯ Seal Intact	yes											
⑰ Date	1/6											
⑱ Checked by (Initials)												

Placed in cold room

⑲ Relinquished by				
⑳ Date				
㉑ Time				
㉒ Received by				

APPENDIX L

QUALITY ASSURANCE DATA

L.1 PCDD/PCDF Blank Trains L-2
L.2 PCDD/PCDF Duplicate Sample Analyses L-10
L.3 PCDD/PCDF Internal QA and Instrument Performance Results L-16
L.4 PCDD/PCDF Relative Response Factors L-45
L.5 EPA Audit Sample Results L-70
L.6 Metals Spikes and NBS Standard Recoveries L-82
L.7 Metals Calibration Data L-86
L.8 Metals Duplicate Sample Analysis L-91
L.9 CEM Calibration Data L-94
L.10 EPA Audit Reports L-111

L.1 PCDD/PCDF Blank Trains

TABLE L-1. SUMMARY OF BLANK TRAIN DATA

Sample	Analytes identified	Amount found (ng)
13012-13016 proof blank	Total TCDD	0.027
	Octa-CDD	0.14
15012-15016 field blank	Octa-CDD	0.06
18012-18016 post blank	Total TCDD	0.024
		0.073

0F130126

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X8
SAMPLE ID: 13012-13016 (PROOF BLK)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1829	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1310430	NA	2.35	NA
2754	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	1977350	NA	4.90	NA
1758	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	609216	0.565		47.1
2264	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1042750	1.229		50.2
2643	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	1710470	2.863		57.8
2916	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1073640	2.630		54.2
1856	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	438784	0.581		46.5
2391	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	541084	1.248		50.3
2728	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1029360	2.712		55.4
2999	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	603484	2.398		48.9
3244	13C-OCDD	470/472 (87/100)	472	0.605	1509350	6.187		50.3
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	5789	NDK	0.00440	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	4949	NDK	0.00512	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	1820	NDK	0.00235	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.303	6435	NDK	0.0122	
NA	OCTA-CDF	442/444 (87/100)	442+444	2.192	5374	NDK	0.0200	
1570	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	22721		0.0273	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	7277	NDK	0.0114	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	6825	NDK	0.0140	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	5472	NDK	0.0146	
3244	OCTA-CDD	458/460 (87/100)	458+460	2.044	36077		0.144	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: Mike Kelly DATE: 3/8/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/8/88 REVIEWED: Kirk Hadley DATE: 3/8/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/8/88 REVIEWED:__________ DATE:________

DF130126

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X8
SAMPLE ID: 13012-13016 (PROOF BLK)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.18 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICATED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1760	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	6658	NDK	0.00506	
2258	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	12365	NDK	0.0123	
2266	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	12365	NDK	0.0146	
2350	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	12365	NDK	0.0128	
2645	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	1820	NDK	0.00226	
2655	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	1820	NDK	0.00208	
2665	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	1820	NDK	0.00345	
2708	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	1820	NDK	0.00235	
2772	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	9628	NDK	0.0136	
2918	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	14014	NDK	0.0266	
3031	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	9524	NDK	0.0205	
3251	OCTA-CDF	442/444 (87/100)	442+444	2.192	5374	NDK	0.0208	
1858	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	12690	NDK	0.0153	
2393	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	7277	NDK	0.0114	
2720	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	5496	NDK	0.0142	
2730	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	5496	NDK	0.0191	
2757	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	4618	NDK	0.00946	
3001	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	6910	NDK	0.0185	
3246	OCTA-CDD	458/460 (87/100)	458+460	2.044	36077		0.144	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: DATE: 3/8/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/8/88 REVIEWED: DATE: 3/8/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/8/88 REVIEWED:__________ DATE:________

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PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X9
SAMPLE ID: 15012-15016 (FIELD BLK)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTL2%OL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1829	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1020330	NA	2.35	NA
2755	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	1490020	NA	4.90	NA
1750	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	505024	0.602		50.1
2264	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	895980	1.357		55.4
2644	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	1401960	3.096		62.5
2915	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	884080	2.860		59.0
1856	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	340992	0.580		46.4
2398	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	421164	1.247		50.3
2728	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	845612	2.940		60.0
2999	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	521996	2.737		55.9
3245	13C-OCDD	470/472 (87/100)	472	0.605	1293990	6.997		56.9
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	5789	NDK	0.00530	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	3299	NDK	0.00397	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	2738	NDK	0.00431	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	2970	NDK	0.00683	
NA	OCTA-CDF	442/444 (87/100)	442+444	2.192	7259	NDK	0.0315	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	11579	NDK	0.0179	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	14622	NDK	0.0296	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	6579	NDK	0.0164	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	5338	NDK	0.0165	
3245	OCTA-CDD	458/460 (87/100)	458+460	2.044	12942		0.0602	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: Mike Mill DATE: 3/8/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/7/88 REVIEWED: Mike Mills DATE: 3/8/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/7/88 REVIEWED:__________ DATE:________

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PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X9
SAMPLE ID: 15012-15016 (FIELD BLK)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE. RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1760	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	7017	NOK	0.00643	
2258	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	3299	NOK	0.00382	
2266	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	3299	NOK	0.00454	
2350	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	3299	NOK	0.00397	
2646	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	2730	NOK	0.00414	
2656	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	2730	NOK	0.00380	
2666	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	2730	NOK	0.00631	
2709	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	2730	NOK	0.00431	
2773	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	2730	NOK	0.00471	
2917	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	2970	NOK	0.00683	
3030	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	7564	NOK	0.0198	
3250	OCTA-CDF	442/444 (87/100)	442+444	2.192	7259	NOK	0.0315	
1858	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	7677	NOK	0.0119	
2392	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	14622	NOK	0.0296	
2720	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	6947	NOK	0.0218	
2730	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	6210	NOK	0.0262	
2757	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	6579	NOK	0.0164	
3001	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	5338	NOK	0.0165	
3245	OCTA-CDD	458/460 (87/100)	458+460	2.044	12942		0.0602	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: Mike Miller DATE: 3/8/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/7/88 REVIEWED: Mike Miller DATE: 3/8/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/7/88 REVIEWED: ____________ DATE: ________

DF100126

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X10
SAMPLE ID: 18012-18016 (POST BLK)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1827	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1212798	NA	2.35	NA
2753	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	1759560	NA	4.90	NA
1756	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	648984	0.650		54.2
2262	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1077710	1.373		56.0
2641	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.498	1711720	3.220		65.0
2914	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1015508	2.796		57.6
1854	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	456000	0.654		52.3
2308	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	536934	1.338		54.0
2726	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.948	977556	2.895		59.1
2997	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	609544	2.722		55.6
3243	13C-OCDD	470/472 (87/100)	472	0.605	1413400	6.510		52.9
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	5210	NDK	0.00371	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	6677	NDK	0.00668	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	4550	NDK	0.00588	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	4950	NDK	0.00992	
NA	OCTA-CDF	442/444 (87/100)	442+444	2.192	9323	NDK	0.0378	
1568	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	20425		0.0236	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	9897	NDK	0.0157	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	6825	NDK	0.0147	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	7462	NDK	0.0198	
3243	OCTA-CDD	458/460 (87/100)	458+460	2.044	17842		0.0726	

GC/MS ANALYST: R. ROBSON   ANALYSIS DATE: 1/31/88   DATA ENTRY REVIEWED: Mike Miller DATE: 3/8/98
DATA ANALYST: M. WHITACRE   ANALYSIS DATE: 3/8/88   REVIEWED: DATE: 3/8/98
DATA ENTRY: M. WHITACRE   ENTRY DATE: 3/8/88   REVIEWED:__________ DATE:________

8F100126

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X10
SAMPLE ID: 10012-10016 (POST BLK)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICATED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1758	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	8997	NDK	0.00641	
2256	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	6677	NDK	0.00643	
2264	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	6677	NDK	0.00764	
2340	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	9594	NDK	0.00960	
2643	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	5764	NDK	0.00716	
2653	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	5764	NDK	0.00657	
2663	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	5764	NDK	0.0109	
2706	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	5764	NDK	0.00745	
2770	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	4768	NDK	0.00674	
2916	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.303	8752	NDK	0.0175	
3029	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	5400	NDK	0.0123	
3250	OCTA-CDF	442/444 (87/100)	442+444	2.192	9323	NDK	0.0378	
1856	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	12395	NDK	0.0143	
2390	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	9729	NDK	0.0155	
2718	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	4945	NDK	0.0134	
2728	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	7708	NDK	0.0282	
2755	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	4791	NDK	0.0103	
2999	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	12054	NDK	0.0349	
3245	OCTA-CDD	458/460 (87/100)	458+460	2.044	17042		0.0726	

GC/MS ANALYST: R. ROBSON   ANALYSIS DATE: 1/31/88   DATA ENTRY REVIEWED: ______ DATE: 3/8/88

DATA ANALYST: M. WHITACRE   ANALYSIS DATE: 3/8/88   REVIEWED: ______ DATE: 3/8/88

DATA ENTRY: M. WHITACRE   ENTRY DATE: 3/8/88   REVIEWED: ______ DATE: ______

L.2 PCDD/PCDF Duplicate Sample Analyses

TABLE L-2. PRECISION RESULTS FOR DUPLICATE INJECTION OF MM5 SAMPLE

Analyte	Amount found (ng)	Amount found (ng)	Average (ng)	Precision (RPD)[a] (%)
Total tetra-CDF	3.72	3.65	3.69	2
Total penta-CDF	2.97	3.11	3.04	5
Total hexa-CDF	1.709	1.75	1.73	2
Total hepta-CDF	0.953	0.979	0.97	3
Octa-CDF	0.251	0.259	0.26	3
Total tetra-CDD	0.674	0.683	0.68	1
Total penta-CDD	0.716	0.716	0.72	0
Total hexa-CDD	1.082	1.14	1.11	5
Total hepta-CDD	0.963	0.968	0.97	1
Octa-CDD	1.056	1.019	1.04	4
2,3,7,8-Tetra-CDF	0.504	0.528	0.52	5
1,2,3,4,8-Penta-CDF	0.0561	0.0662	0.061	17
1,2,3,7,8-Penta-CDF	0.225	0.252	0.24	11
2,3,4,7,8-Penta-CDF	0.228	0.245	0.24	7
1,2,3,4,7,8-Hexa-CDF	0.332	0.317	0.32	5
1,2,3,6,7,8-Hexa-CDf	0.171	0.176	0.17	3
1,2,3,4,7,9-Hexa-CDF	ND[b] <0.0511	ND < 0.0498	-	-
2,3,4,6,7,8-Hexa-CDF	0.196	0.194	0.19	1
1,2,3,7,8,9-Hexa-CDF	0.0133	0.0233	0.018	56
1,2,3,4,6,7,8-Hepta-CDF	0.604	0.603	0.60	< 1
1,2,3,4,7,8,9-Hepta-CDF	0.111	0.124	0.12	11
Octa-CDF	0.251	0.259	0.26	3
2,3,7,8-TCDD	0.0465	0.0464	0.046	< 1
1,2,3,7,8-Penta-CDD	0.0725	0.0683	0.070	6
1,2,3,4,7,8-Hexa-CDD	0.0690	0.0806	0.075	15
1,2,3,6,7,8-Hexa-CDD	0.152	0.135	0.14	12
1,2,3,7,8,9-Hexa-CDD	0.119	0.129	0.12	8
1,2,3,4,6,7,8-Hepta-CDD	0.510	0.508	0.51	< 1
Octa-CDD	1.056	1.02	1.04	3
GC/MS data file:	8910A31X4		8910A31X5	
Sample ID:	1028-1032 (MM5 outlet)	1028-1032 (MM5 outlet Rep. inj.)		
Analyis date:	1/31/88		1/31/88	

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[a] RPD (relative percent difference) = range ÷ mean x 100 (%).

[b] ND = Not detected.

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PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910831X4
SAMPLE ID: 1028-1032 (MMS OUTLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1830	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1665950	NA	2.35	NA
2756	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2443070	NA	4.90	NA
1760	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	784144	0.572		47.7
2265	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1318680	1.223		49.9
2645	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2018420	2.735		55.2
2918	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1258290	2.495		51.4
1857	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	549552	0.573		45.8
2392	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	645404	1.171		47.2
2730	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1208270	2.577		52.6
3001	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	763478	2.456		50.1
3246	13C-OCDD	470/472 (87/100)	472	0.605	1790310	5.939		48.3
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	6304596		3.72	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	3631907		2.97	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	1559069		1.709	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	589004		0.953	
3256	OCTA-CDF	442/444 (87/100)	442+444	2.192	80047		0.251	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	701598		0.674	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	543260		0.716	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	620371		1.082	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	455632		0.963	
3246	OCTA-CDD	458/460 (87/100)	458+460	2.044	314143		1.056	

GC/MS ANALYST:	R. ROBSON	ANALYSIS DATE:	1/31/88	DATA ENTRY REVIEWED: Mike Milly	DATE: 3/21/88
DATA ANALYST:	M. WHITACRE	ANALYSIS DATE:	3/7/88	REVIEWED: Mike Milly	DATE: 3/21/88
DATA ENTRY:	M. WHITACRE	ENTRY DATE:	3/7/88	REVIEWED:________	DATE:________

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PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31X4
SAMPLE ID: 1028-1032 (MM5 OUTLET)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1762	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.534	853992		0.504	
2253	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	71365		0.0561	
2267	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	240611		0.225	
2351	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	278303		0.228	
2647	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	314694		0.332	
2657	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	176442		0.171	
2667	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	31850	NDK	0.0511	
2710	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	179025		0.196	
2774	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	11058		0.0133	
2920	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	373292		0.604	
3033	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	60309		0.111	
3253	OCTA-CDF	442/444 (87/100)	442+444	2.192	88047		0.251	
1859	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	48427		0.0465	
2394	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	54956		0.0725	
2722	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	31414		0.0690	
2732	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	51465		0.152	
2759	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	68018		0.119	
3083	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	241336		0.510	
3248	OCTA-CDD	458/460 (87/100)	458+460	2.044	314143		1.056	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: ______ DATE: 3/21/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/7/88 REVIEWED: ______ DATE: 3/21/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/7/88 REVIEWED: ______ DATE: ______

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PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A31XS
SAMPLE ID: 1028-1032 (MMS OUTLET REP.INJ.)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1028	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1668940	NA	2.35	NA
2755	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2593690	NA	4.90	NA
1757	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	732448	0.533		44.5
2263	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1276520	1.182		48.2
2644	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2074010	2.647		53.5
2917	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1307960	2.443		50.4
1855	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	542080	0.564		45.1
2390	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	657256	1.190		48.0
2729	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1238450	2.488		50.8
3008	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	810500	2.456		50.1
3246	13C-OCDD	470/472 (87/100)	472	0.605	1969340	6.154		50.0
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	5780077		3.65	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	3689166		3.11	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	1642013		1.75	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	629102		0.979	
3255	OCTA-CDF	442/444 (87/100)	442+444	2.192	98864		0.259	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	701393		0.683	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	553070		0.716	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	672152		1.14	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	486412		0.968	
3246	OCTA-CDD	458/460 (82/100)	458+460	2.044	333528		1.019	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: DATE: 3/22/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/7/88 REVIEWED: DATE: 3/22/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/7/88 REVIEWED:__________ DATE:______

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910831XS
SAMPLE ID: 1028-1032 (MMS OUTLET REP.INJ.)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1759	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	836120		0.528	
2257	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	81538		0.0662	
2265	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	261196		0.252	
2349	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	290587		0.245	
2646	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	308954		0.317	
2656	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	187072		0.176	
2666	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	31850	NOC	0.0498	
2709	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	182065		0.194	
2773	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	19959		0.0233	
2919	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	387280		0.603	
3032	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	70032		0.124	
3253	OCTA-CDF	442/444 (87/100)	442+444	2.192	98864		0.259	
1857	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	47667		0.0464	
2392	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	52761		0.0683	
2721	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	37632		0.0806	
2731	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	46742		0.135	
2750	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	75556		0.129	
3002	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	255093		0.508	
3248	OCTA-CDD	458/460 (87/100)	458+460	2.044	333528		1.02	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED: Mike Molly DATE: 3/7/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/7/88 REVIEWED: Mike Molly DATE: 3/22/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/7/88 REVIEWED: ________ DATE: ________

L.3 PCDD/PCDF Internal QA and Instrument Performance Results

TABLE L-3. DIOXIN/FURAN RESULTS FOR THE INSTRUMENT PERFORMANCE SAMPLE

Analyte	Found (ng)	Theoretical (ng)	Accuracy (%)
2,3,7,8-TCDD	68.7	67.8	101

TABLE L-4. DIOXIN/FURAN RESULTS FOR BLANK QA PERFORMANCE SAMPLES[a]

Sample	Analytes detected	Amount (ng)
XAD (04512)	Octa-CDD	0.032
Filter (04517)	none	-
XAD and filter (04519)	Octa-CDD	0.027
Water (04515)	Octa-CDD	0.010

[a] Detection limits for dioxins and furans ranged from 0.002 to 0.04 ng.

TABLE L-5. TOTAL DIOXIN/FURAN RESULTS FOR SPIKED QA PERFORMANCE SAMPLES[a]

Analyte	Spiked XAD (04513)			Spiked filter (04516)			Spiked XAD + filter (04518)			Spiked water (04514)		
	Found (ng)	Theor. (ng)	Accuracy (%)	Found (ng)	Theor. (ng)	Accuracy (%)	Found (ng)	Theor. (ng)	Accuracy (%)	Found (ng)	Theor. (ng)	Accuracy (%)
Total tetra-CDF	1.043	1.0	104	0.391	0.40	98	0.362	0.40	91	0.362	0.40	91
Total penta-CDF	1.959	2.0	98	0.74	0.80	93	0.663	0.80	83	0.655	0.80	82
Total hexa-CDF	9.420	10.0	94	3.98	4.0	100	3.287	4.0	82	3.069	4.0	77
Total hepta-CDF	5.0071	5.0	100	1.83	2.0	92	1.676	2.0	84	1.435	2.0	72
Octa-CDF	4.554	5.0	91	1.53	2.0	77	1.688	2.0	84	1.901	2.0	95
Total tetra-CDD	0.9790	1.0	98	0.361	0.40	90	0.377	0.46	94	0.365	0.40	91
Total penta-CDD	0.965	1.0	97	0.352	0.40	88	0.344	0.46	86	0.347	0.40	87
Total hexa-CDD	7.016	7.5	94	2.66	3.0	89	2.507	3.0	84	2.104	3.0	70
Total hepta-CDD	2.010	2.5	80	0.740	1.0	74	0.754	1.0	75	0.705	1.0	71
Octa-CDD	4.694	5.0	94	1.69	2.0	85	1.735	2.0	87	1.661	2.0	83

[a] All values met the data quality objective for accuracy of 50-150%.

TABLE L-6. ISOMER SPECIFIC DIOXIN/FURAN RESULTS FOR SPIKED QA PERFORMANCE SAMPLES

Analyte	Spiked XAD (04513)			Spiked filter (04516)			Spiked XAD + filter (04518)			Spiked water (04514)		
	Found (ng)	Theor. (ng)	Accuracy (%)	Found (ng)	Theor. (ng)	Accuracy (%)	Found (ng)	Theor. (ng)	Accuracy (%)	Found (ng)	Theor. (ng)	Accuracy (%)
2,3,7,8-Tetra-CDF	1.0331	1.0	103	0.391	0.40	98	0.363	0.40	91	0.362	0.40	91
1,2,3,7,8-Penta-CDF	1.131	1.0	113	0.430	0.40	108	0.358	0.40	90	0.362	0.40	91
2,3,4,7,8-Penta-CDF	0.938	1.0	94	0.396	0.40	99	0.3503	0.40	88	0.339	0.40	85
1,2,3,4,7,8-Hexa-CDF	2.530	2.5	101	0.929	1.0	93	0.869	1.0	87	0.961	1.0	96
1,2,3,6,7,8-Hexa-CDF	2.159	2.5	86	1.001	1.0	100	0.8097	1.0	81	0.797	1.0	80
2,3,4,6,7,8-Hexa-CDF	2.356	2.5	94	1.024	1.0	102	0.812	1.0	81	0.778	1.0	78
1,2,3,7,8,9-Hexa-CDF	2.174	2.5	87	0.984	1.0	98	0.714	1.0	71	0.425	1.0	43[a]
1,2,3,4,6,7,8-Hepta-CDF	2.908	2.5	116	1.120	1.0	112	0.971	1.0	97	0.900	1.0	90
1,2,3,4,7,8,9-Hepta-CDF	2.387	2.5	95	0.803	1.0	80	0.801	1.0	80	0.608	1.0	61
Octa-CDF	4.554	5.0	91	1.53	2.0	77	1.701	2.0	85	1.901	2.0	95
2,3,7,8-TCDD	0.979	1.0	98	0.361	0.40	90	0.377	0.40	94	0.364	0.40	91
1,2,3,7,8-Penta-CDD	0.965	1.0	97	0.352	0.40	88	0.344	0.40	86	0.347	0.40	87
1,2,3,4,7,8-Hexa-CDD	3.276	2.5	131	1.088	1.0	109	0.972	1.0	97	1.073	1.0	107
1,2,3,6,7,8-Hexa-CDD	3.368	2.5	135	1.37	1.0	137	1.464	1.0	146	1.163	1.0	116
1,2,3,7,8,9-Hexa-CDD	2.425	2.5	97	0.988	1.0	99	0.8705	1.0	87	0.565	1.0	57
1,2,3,4,6,7,8-Hepta-CDD	2.010	2.5	80	0.723	1.0	72	0.754	1.0	75	0.705	1.0	71
Octa-CDD	4.694	5.0	94	1.69	2.0	85	1.735	2.0	87	1.661	2.0	83

[a] This value did not meet the data quality objective for accuracy of 50-150%.

MIDWEST RESEARCH INSTITUTE QUALITY ASSURANCE REPORT

Date: April 11, 1988
To: J. Coates
Distribution: C. Cowherd, C. Green, C. Haile, [redacted], M. Whitacre
From: T. Dux, D. Hooton
Subject: Summary of Auditing Results for Dioxin and Furan Analyses - MERC Trial Burn - Project No. 8910

This report summarizes audit results covering dioxin and furan analyses. The QAC, under the direction of the Project QAC, audited the final analysis results and supporting records.

Specifically the audit consisted of the following activities:

- The test plan, QA plan and analytical method was read.
- All GC/MS logbook pages were read.
- The sample preparation and GC/MS analysis was compared for compliance to the test plan, the QA plan and the methods.
- One sample was completely traced from sample preparation through final result and the analytical results were verified.
- The surrogate spiking standard and calibration standards preparation was reviewed and selected analyte concentrations were traced and verified.
- All sample preparation was reviewed.
- The calibration curve and subsequent daily calibration was examined to ensure criteria were met.
- Nine QC samples were submitted and prepared by D. Hooton;They were extracted and analyzed by the project team. The results were reported in a memo 4/4/88.

All the records generally contained information on sample analysis problems, qualitative observations, laboratory procedures for sample preparation, sample analysis and calculations, plus evidence of technical data review. With one exception (item 6 below,) the data was generally traceable and appeared to meet project requirements. The documentation indicates that the sample preparation and analysis was done in accordance with the test plan, QA plan and applicable methods. The project team did a fine job and produced data which should meet the client's requirements.

Attached are the final data tables for the D/F QA performance audit samples.

Table 1 - D/F Results for Instrument Performance Sample
Table 2 - D/F Results for Blank QA Performance Sample
Table 3 - Total D/F Results for Spiked QA Performance Samples
Table 4 - Isomer Specific D/F Results for Spiked QA Performance Samples

The following QA/QC items need to be addressed before the release of the data. This project is subject to external audit. Some of these items may not be problems but arise from a misunderstanding by the QAC.

(1) The RRFs in the Response Factor Comparison Table for the daily calibration, A30XQ2 were not the same as the RRFs from the Lotus spreadsheet for this analysis. Specifically the discrepancy was noted for

2,3,7,8-TCDF, 1,2,3,4,8-PCDF, 1,2,3,7,8-PCDF, 1,2,3,4,7,9-HCDF and 1,2,3,6,7,8-HCDF. Recommendation: Correct table and submit to QAC.

(2) The method internal standard recoveries for some samples did not meet the data quality objective for accuracy of 50 to 150 % (Table 5-1). This problem is under investigation by project personnel. Recommendation: A written statement of corrective action, remedial action or technical explanation should accompany the results before data is released to the client. Remember, this data is subject to external audit by RTI.

(3) The QA plan (Section 7) indicates that samples would be tracked using traceablity sheets or the barcode system. Recommendation: Add documentation to the project records.

(4) It appears that the characteristic ion area ratio for 13C-1,2,3,4,7,8-HxCDF in sample 3011-3013 (8910A30X11) did not meet the criteria of +/- 20 % of theoretical. Also the peak response for both ions was seperated by 5 seconds, however the ASME protocol states they need to maximize simultaneously (+/- 1 sec, Section 8.5.1.) This possible difficulty and its possible systematic impact upon other sample results needs to be reviewed by technical staff. Recommendation: Provide comment or technical evaluation to the raw data.

(5) The sample preparation log indicates that ash sample 1044 was dried at room temperature for ~ 2 days, while other ash samples were not dried. Consideration needs to be given as to whether the results will be reported as dry weight or wet weight results. The log indicates that all other ash samples were determined based upon wet weight. Recommendation: Flag affected data or confirm in writing that ash results will not be reported.

(6) The sample preparation log has a space for recording the spiking of the samples with method internal standards. Currently the spiking of samples is recorded in a second notebook and the actual amount of analtye spiked is not calculated. No calculations or references to the spiking are provided on the sample preparation forms. Recommendation: Analysts should reference in the preparation log, the book number and page of the spiking activities and specify the amount spiked for each analyte. Corrective action for future projects should be to record the information in the sample preparation log. This will consolidate sample preparation records and improve data traceability

TABLE 1. DIOXIN/FURAN RESULTS FOR THE INSTRUMENT PERFORMANCE SAMPLE

Analyte	Found (ng)	Theoretical (ng)	Accuracy (%)
2,3,7,8-TCDD	68.7	67.8	101

TABLE 2. DIOXIN/FURAN RESULTS FOR BLANK QA PERFORMANCE SAMPLES[a]

Sample	Analytes detected	Amount (ng)
XAD (04512)	Octa-CDD	0.032
Filter (04517)	none	-
XAD and filter (04519)	Octa-CDD	0.027
Water (04515)	Octa-CDD	0.010

[a] Detection limits for dioxins and furans ranged from 0.002 to 0.04 ng.

TABLE 3. TOTAL DIOXIN/FURAN RESULTS FOR SPIKED QA PERFORMANCE SAMPLES[a]

Analyte	Spiked XAD (04513)			Spiked filter (04516)			Spiked XAD + filter (04518)			Spiked water (04514)		
	Found (ng)	Theor. (ng)	Accuracy (%)	Found (ng)	Theor. (ng)	Accuracy (%)	Found (ng)	Theor. (ng)	Accuracy (%)	Found (ng)	Theor. (ng)	Accuracy (%)
Total tetra-CDF	1.043	1.0	104	0.391	0.40	98	0.362	0.40	91	0.362	0.40	91
Total penta-CDF	1.959	2.0	98	0.74	0.80	93	0.663	0.80	83	0.655	0.80	82
Total hexa-CDF	9.420	10.0	94	3.98	4.0	100	3.287	4.0	82	3.069	4.0	77
Total hepta-CDF	5.0071	5.0	100	1.83	2.0	92	1.676	2.0	84	1.435	2.0	72
Octa-CDF	4.554	5.0	91	1.53	2.0	77	1.688	2.0	84	1.901	2.0	95
Total tetra-CDD	0.9790	1.0	98	0.361	0.40	90	0.377	0.46	94	0.365	0.40	91
Total penta-CDD	0.965	1.0	97	0.352	0.40	88	0.344	0.46	86	0.347	0.40	87
Total hexa-CDD	7.016	7.5	94	2.66	3.0	89	2.507	3.0	84	2.104	3.0	70
Total hepta-CDD	2.010	2.5	80	0.740	1.0	74	0.754	1.0	75	0.705	1.0	71
Octa-CDD	4.694	5.0	94	1.69	2.0	85	1.735	2.0	87	1.661	2.0	83

[a] All values met the data quality objective for accuracy of 50-150%.

TABLE 4. ISOMER SPECIFIC DIOXIN/FURAN RESULTS FOR SPIKED QA PERFORMANCE SAMPLES

Analyte	Spiked XAD (04513)			Spiked filter (04516)			Spiked XAD + filter (04518)			Spiked water (04514)		
	Found (ng)	Theor. (ng)	Accuracy (%)	Found (ng)	Theor. (ng)	Accuracy (%)	Found (ng)	Theor. (ng)	Accuracy (%)	Found (ng)	Theor. (ng)	Accuracy (%)
2,3,7,8-Tetra-CDF	1.0331	1.0	103	0.391	0.40	98	0.363	0.40	91	0.362	0.40	91
1,2,3,7,8-Penta-CDF	1.131	1.0	113	0.430	0.40	108	0.358	0.40	90	0.362	0.40	91
2,3,4,7,8-Penta-CDF	0.938	1.0	94	0.396	0.40	99	0.3503	0.40	88	0.339	0.40	85
1,2,3,4,7,8-Hexa-CDF	2.530	2.5	101	0.929	1.0	93	0.869	1.0	87	0.961	1.0	96
1,2,3,6,7,8-Hexa-CDF	2.159	2.5	86	1.001	1.0	100	0.8097	1.0	81	0.797	1.0	80
2,3,4,6,7,8-Hexa-CDF	2.356	2.5	94	1.024	1.0	102	0.812	1.0	81	0.778	1.0	78
1,2,3,7,8,9-Hexa-CDF	2.174	2.5	87	0.984	1.0	98	0.714	1.0	71	0.425	1.0	43[a]
1,2,3,4,6,7,8-Hepta-CDF	2.908	2.5	116	1.120	1.0	112	0.971	1.0	97	0.900	1.0	90
1,2,3,4,7,8,9-Hepta-CDF	2.387	2.5	95	0.803	1.0	80	0.801	1.0	80	0.608	1.0	61
Octa-CDF	4.554	5.0	91	1.53	2.0	77	1.701	2.0	85	1.901	2.0	95
2,3,7,8-TCDD	0.979	1.0	98	0.361	0.40	90	0.377	0.40	94	0.364	0.40	91
1,2,3,7,8-Penta-CDD	0.965	1.0	97	0.352	0.40	88	0.344	0.40	86	0.347	0.40	87
1,2,3,4,7,8-Hexa-CDD	3.276	2.5	131	1.088	1.0	109	0.972	1.0	97	1.073	1.0	107
1,2,3,6,7,8-Hexa-CDD	3.368	2.5	135	1.37	1.0	137	1.464	1.0	146	1.163	1.0	116
1,2,3,7,8,9-Hexa-CDD	2.425	2.5	97	0.988	1.0	99	0.8705	1.0	87	0.565	1.0	57
1,2,3,4,6,7,8-Hepta-CDD	2.010	2.5	80	0.723	1.0	72	0.754	1.0	75	0.705	1.0	71
Octa-CDD	4.694	5.0	94	1.69	2.0	85	1.735	2.0	87	1.661	2.0	83

[a] This value did not meet the data quality objective for accuracy of 50-150%.

INTEROFFICE COMMUNICATION

CC: J. Coates
C. Cowherd
C. Green
C. Haile
G. Scheil

April 14, 1988

TO: Tom Dux, Dennis Hooton
FROM: Marilyn Whitacre MW
SUBJECT: Corrective action response to Quality Assurance memo dated April 11, 1988, Project 8910L02-14 MERC.

(1) Problem: The RRFs in the Response Factor Comparison Table for the daily calibration, A30XQ2, were not the same as the RRFs from the Lotus spreasheet for this analysis.

Response: The Response Factor Comparison Table master spreadsheet was not current, 4 analytes were switched. This did not affect the data on that day since the response factors are quantitated from the calibration curve. The spreadsheet has been corrected.

(2) Problem: The method internal standard recoveries for some samples did not meet the data quality objective for accuracy of 50-150%.

Response: This problem was invesigated extensively and no explanation found. A statement concerning the low recoveries will be written in the final report.

(3) Problem: The QA plan indicates the samples would be tracked using traceability sheets. These sheets were not in the project documentation.

Response: Traceability sheets were used on the project but were not included in with the project documentation. They have now been added.

(4) Problem: It appears that the characteristic ion area ratio for 13C-1,2,3,4,7,8-HxCDF in sample 3011-3013 did not meet the criteria of +/- 20% of theoretical. Also the peak response for both ions was separated by 5 scans.

Response: The only peak of interest in this window is the 13C-1,2,3,4,7,8-HxCDF. The fact that the two ions were 5 scans apart indicates the resolution was slightly different for this peak. This did not have an impact on the sample or any others.

(5) Problem: Ash sample 1044 was dried for 2 days while the other samples were not.

Response: Ash sample 1044 was very wet upon initial inspection and the other samples were dry. We thought it would be best if all the samples were alike (dry). We routinely extract samples as they come into the laboratory. The ash samples were extracted in the lab and then sent to MERC for possible analysis.

(6) Problem: Recording the spiking of the samples with method internal standard.

Response: For current and future projects, the amount spiked will be recorded in the project notebook and will reference the notebook number and page where the solution was prepared.

QA04520X

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A29XQ3
SAMPLE ID: QA04520 P.A.S.

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	9.40 ng
13C-1,2,3,7,8,9-HxCDD	19.6 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	2.40 NG
13C-1,2,3,7,8-PeCDF	4.90 NG
13C-1,2,3,4,7,8-HxCDF	9.90 NG
13C-1,2,3,4,6,7,8-HpCDF	9.70 NG

VOLUME USED = 0.05 mL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	2.50 NG
13C-1,2,3,7,8-PeCDD	4.95 NG
13C-1,2,3,6,7,8-HxCDD	9.80 NG
13C-1,2,3,4,6,7,8-HpCDD	9.80 NG
13C-OCDD	24.5 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)/VOLUME USED

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG/mL)	SURROGATE RECOVERY (%)
1839	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	884128	NA	9.40	NA
2757	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	1777540	NA	19.60	NA
1767	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	391720	2.154		89.7
2270	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	707120	4.942		100.9
2646	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	1168290	8.702		87.9
2917	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	772096	8.417		86.8
1867	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	264832	2.080		83.2
2395	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	352584	4.821		97.4
2730	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	707560	8.296		84.7
2999	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	480596	8.499		86.7
3244	13C-OCDD	470/472 (87/100)	472	0.605	1208870	22.048		90.0
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	6947	ND<	0.328	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	5279	ND<	0.322	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	5005	ND<	0.379	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	4950	ND<	0.522	
NA	OCTA-CDF	442/444 (87/100)	442+444	2.192	8060	ND<	1.49	
1869	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	861028		68.7	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	9897	ND<	0.954	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	6825	ND<	0.813	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	4975	ND<	0.668	
NA	OCTA-CDD	458/460 (87/100)	458+460	2.044	5911	ND<	1.17	

GC/MS ANALYST:	D. MILLS	ANALYSIS DATE:	1/29/88	DATA ENTRY REVIEWED: Mike Dolly	DATE: 3/8/88
DATA ANALYST:	M. WHITACRE	ANALYSIS DATE:	3/14/88	REVIEWED: Mike Dolly	DATE: 3/8/88
DATA ENTRY:	M. WHITACRE	ENTRY DATE:	3/14/88	REVIEWED:____________	DATE:__________

QA04520X

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)/VOLUME USED

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A29X03
SAMPLE ID: QA04520 P.A.S.

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 9.40 ng
13C-1,2,3,7,8,9-HxCDD 19.6 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF 2.40 NG
13C-1,2,3,7,8-PeCDF 4.90 NG
13C-1,2,3,4,7,8-HxCDF 9.90 NG
13C-1,2,3,4,6,7,8-HpCDF 9.70 NG

VOLUME USED = 0.050 mL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD 2.50 NG
13C-1,2,3,7,8-PeCDD 4.95 NG
13C-1,2,3,6,7,8-HxCDD 9.80 NG
13C-1,2,3,4,6,7,8-HpCDD 9.80 NG
13C-OCDD 24.5 NG

PREDICTED SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG/mL)	SURROGATE RECOVERY (%)
1769	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	8638	NDK	0.408	
2264	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	5279	NDK	0.310	
2272	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	5279	NDK	0.223	
2356	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	5279	NDK	0.322	
2648	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	5005	NDK	0.361	
2658	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	5005	NDK	0.334	
2668	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	5005	NDK	0.555	
2711	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	5005	NDK	0.379	
2775	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	5396	NDK	0.447	
2919	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	4974	NDK	0.525	
3032	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	4994	NDK	0.599	
3251	OCTA-CDF	442/444 (87/100)	442+444	2.192	8060	NDK	1.49	
1869	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	861028		68.7	
2397	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	9897	NDK	0.954	
2722	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	6825	NDK	1.024	
2732	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	6825	NDK	1.38	
2759	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	6825	NDK	0.813	
3001	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	4975	NDK	0.668	
3246	OCTA-CDD	458/460 (87/100)	458+460	2.044	5911	NDK	1.17	

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 1/29/88 DATA ENTRY REVIEWED: DATE: 3/18/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/14/88 REVIEWED: DATE: 3/18/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/14/88 REVIEWED: ________ DATE: ________

QA04512X

PAGE 1: TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A29X1
SAMPLE ID: QA 04512 (XAD)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1825	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1558230	NA	2.35	NA
2748	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2470810	NA	4.90	NA
1755	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	838272	0.654		54.5
2258	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1618170	1.604		65.5
2636	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2503290	3.353		67.7
2908	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1686250	3.306		68.2
1852	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	627328	0.699		55.9
2384	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	746504	1.448		58.4
2721	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1608910	3.393		69.2
2991	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	1022400	3.252		66.4
3236	13C-OCDD	470/472 (87/100)	472	0.605	2440890	8.007		65.1
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	8684	NDK	0.00479	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	3299	NDK	0.00220	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	5460	NDK	0.00482	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	6439	NDK	0.00777	
NA	OCTA-CDF	442/444 (87/100)	442+444	2.192	15529	NDK	0.0357	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	10148	NDK	0.00854	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	7918	NDK	0.00903	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	5460	NDK	0.00715	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	8900	NDK	0.0140	
3239	OCTA-CDD	458/460 (87/100)	458+460	2.044	12843		0.0317	

GC/MS ANALYST: D. MILLS   ANALYSIS DATE: 1/29/88   DATA ENTRY REVIEWED: DATE: 3/18/88

DATA ANALYST: M. WHITACRE   ANALYSIS DATE: 3/9/88   REVIEWED: DATE: 3/18/88

DATA ENTRY: M. WHITACRE   ENTRY DATE: 3/9/88   REVIEWED:___________ DATE:_______

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A29X1
SAMPLE ID: QA 04512 (XAD)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 2.35 ng
13C-1,2,3,7,8,9-HxCDD 4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF 1.20 NG
13C-1,2,3,7,8-PeCDF 2.45 NG
13C-1,2,3,4,7,8-HxCDF 4.95 NG
13C-1,2,3,4,6,7,8-HpCDF 4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD 1.25 NG
13C-1,2,3,7,8-PeCDD 2.48 NG
13C-1,2,3,6,7,8-HxCDD 4.90 NG
13C-1,2,3,4,6,7,8-HpCDD 4.90 NG
13C-OCDD 12.3 NG

PREDICTD SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1757	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	10629	NDK	0.00587	
2252	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	3299	NDK	0.00211	
2260	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	3299	NDK	0.00251	
2344	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	3299	NDK	0.00220	
2638	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	5460	NDK	0.00464	
2648	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	5460	NDK	0.00426	
2658	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	5460	NDK	0.00707	
2701	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	5460	NDK	0.00482	
2765	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	5460	NDK	0.00528	
2910	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	6439	NDK	0.00777	
3023	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	6445	NDK	0.00885	
3243	OCTA-CDF	442/444 (87/100)	442+444	2.192	15529	NDK	0.0357	
1854	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	10148	NDK	0.00854	
2386	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	7918	NDK	0.00903	
2713	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	5460	NDK	0.00900	
2723	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	5460	NDK	0.0121	
2750	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	5460	NDK	0.00715	
2993	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	8900	NDK	0.0140	
3238	OCTA-CDD	458/460 (87/100)	458+460	2.044	12843		0.0317	

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 1/29/88 DATA ENTRY REVIEWED: DATE: 3/18/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/9/88 REVIEWED: DATE: 3/18/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/9/88 REVIEWED:__________ DATE:________

QA04513X

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A29X2
SAMPLE ID: QA 04513 (XAD)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1827	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1395870	NA	2.35	NA
2749	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2340030	NA	4.90	NA
1756	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	831680	0.724		60.3
2260	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1479070	1.637		66.8
2638	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2473790	3.499		70.7
2911	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1594270	3.301		68.1
1853	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	596416	0.742		59.3
2385	13C-1,2.3,7,8-PeCDD	366/368 (61/100)	368	0.778	722500	1.564		63.1
2723	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1522510	3.390		69.2
2993	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	1050190	3.527		72.0
3238	13C-OCDD	470/472 (87/100)	472	0.605	2581910	8.943		72.7
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	1874378		1.043	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	2687020		1.959	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	10536884		9.420	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	3921804		5.0071	
3247	OCTA-CDF	442/444 (87/100)	442+444	2.192	2094870		4.554	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	1105536		0.9790	
2387	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	819320		0.965	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	5067556		7.016	
2993	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	1308016		2.010	
3239	OCTA-CDD	458/460 (87/100)	458+460	2.044	2013926		4.694	

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 1/29/88 DATA ENTRY REVIEWED: DATE: 3/18/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/9/88 REVIEWED: DATE: 3/18/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/9/88 REVIEWED:__________ DATE:________

QA04513X

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A29X2
SAMPLE ID: QA 04513 (XAD)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTD SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1758	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	1857220		1.0331	
2254	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	13197	NDX	0.00925	
2262	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	1356864		1.131	
2346	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	1286236		0.938	
2640	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	2942800		2.530	
2650	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	2736660		2.159	
2660	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	13350	NDX	0.0175	
2703	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	2635170		2.356	
2767	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	2222254		2.174	
2913	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	2277940		2.908	
3026	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	1643864		2.387	
3245	OCTA-CDF	442/444 (87/100)	442+444	2.192	2094870		4.554	
1855	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	1105536		0.979	
2387	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	819320		0.965	
2715	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	1879588		3.276	
2725	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	1436064		3.368	
2752	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	1751904		2.425	
2995	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	1308016		2.010	
3240	OCTA-CDD	458/460 (87/100)	458+460	2.044	2013926		4.694	

GC/MS ANALYST: D. MILLS   ANALYSIS DATE: 1/29/88   DATA ENTRY REVIEWED: ______ DATE: 3/19/88

DATA ANALYST: M. WHITACRE   ANALYSIS DATE: 3/9/88   REVIEWED: ______ DATE: 3/18/88

DATA ENTRY: M. WHITACRE   ENTRY DATE: 3/9/88   REVIEWED:__________ DATE:________

QA04514X

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A29X3
SAMPLE ID: QA 04514 (WATER)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1828	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1813560	NA	2.35	NA
2750	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2626870	NA	4.90	NA
1757	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	748864	0.502		41.8
2260	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1282760	1.093		44.6
2639	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2326840	2.932		59.2
2911	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1606810	2.963		61.1
1855	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	394464	0.378		30.2
2385	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	550872	0.918		37.0
2723	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1424790	2.826		57.7
2993	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	831032	2.486		50.7
3238	13C-OCDD	470/472 (87/100)	472	0.605	1764090	5.443		44.3
1759	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	585697		0.362	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	779212		0.655	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	3229320		3.069	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	406+410	2.383	1132632		1.435	
3248	OCTA-CDF	442/444 (87/100)	442+444	2.192	597472		1.901	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	272271		0.365	
2387	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	224816		0.347	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	1422112		2.104	
2994	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	362938		0.705	
3239	OCTA-CDD	458/460 (87/100)	458+460	2.044	486734		1.661	

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 1/29/88 DATA ENTRY REVIEWED: Mike Tr... DATE: 3/18/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/9/88 REVIEWED: Mike Tr... DATE: 3/18/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/9/88 REVIEWED:____________ DATE:________

QA04514X

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A29X3
SAMPLE ID: QA 04514 (WATER)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTD SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1759	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	585697		0.362	
2254	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	7918	ND<	0.00640	
2262	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	376274		0.362	
2346	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	402938		0.339	
2641	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	1051856		0.961	
2651	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	950472		0.797	
2661	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	8431	ND<	0.0117	
2704	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	818708		0.778	
2768	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	408284		0.425	
2913	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	710792		0.900	
3026	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	421840		0.608	
3245	OCTA-CDF	442/444 (87/100)	442+444	2.192	597472		1.901	
1857	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	272271		0.364	
2387	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	224816		0.347	
2715	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	575892		1.073	
2725	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	464184		1.163	
2752	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	382046		0.565	
2995	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	362938		0.705	
3240	OCTA-CDD	458/460 (87/100)	458+460	2.044	486734		1.661	

GC/MS ANALYST: D. MILLS — ANALYSIS DATE: 1/29/88 — DATA ENTRY REVIEWED: — DATE: 3/18/88
DATA ANALYST: M. WHITACRE — ANALYSIS DATE: 3/9/88 — REVIEWED: — DATE: 3/18/88
DATA ENTRY: M. WHITACRE — ENTRY DATE: 3/9/88 — REVIEWED:________ DATE:________

QA04515X

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X1
SAMPLE ID: QA 04515 (WATER)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1861	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1624510	NA	2.35	NA
2784	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2867030	NA	4.90	NA
1789	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	777896	0.582		48.5
2295	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1577750	1.500		61.2
2673	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2631150	3.038		61.4
2942	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1744730	2.948		60.8
1888	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	673376	0.719		57.6
2421	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	792680	1.475		59.5
2757	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1606610	2.920		59.6
3024	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	1113420	3.052		62.3
3268	13C-OCDD	470/472 (87/100)	472	0.605	2883260	8.151		66.3
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	8604	NDK	0.00516	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	13197	NDK	0.00902	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	5460	NDK	0.00459	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	4950	NDK	0.00577	
NA	OCTA-CDF	442/444 (87/100)	442+444	2.192	10747	NDK	0.0209	
1568	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	11706	NDK	0.00918	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	16496	NDK	0.0177	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	6237	NDK	0.00818	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	4975	NDK	0.00721	
3243	OCTA-CDD	458/460 (87/100)	458+460	2.044	4983		0.0184	

GC/MS ANALYST:	R. ROBSON	ANALYSIS DATE:	1/30/88	DATA ENTRY REVIEWED: Mike Miller	DATE: 3/22/98
DATA ANALYST:	M. WHITACRE	ANALYSIS DATE:	3/8/88	REVIEWED: Mike Miller	DATE: 3/22/98
DATA ENTRY:	M. WHITACRE	ENTRY DATE:	3/8/88	REVIEWED: ____________	DATE: ________

QA04515X

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X1
SAMPLE ID: QA 04515 (WATER)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 2.35 ng
13C-1,2,3,7,8,9-HxCDD 4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF 1.20 NG
13C-1,2,3,7,8-PeCDF 2.45 NG
13C-1,2,3,4,7,8-HxCDF 4.95 NG
13C-1,2,3,4,6,7,8-HpCDF 4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD 1.25 NG
13C-1,2,3,7,8-PeCDD 2.48 NG
13C-1,2,3,6,7,8-HxCDD 4.90 NG
13C-1,2,3,4,6,7,8-HpCDD 4.90 NG
13C-OCDD 12.3 NG

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1791	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	15493	NDC	0.00921	
2289	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	13197	NDC	0.00868	
2297	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	13197	NDC	0.0103	
2381	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	13197	NDC	0.00902	
2675	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	5460	NDC	0.00441	
2685	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	5460	NDC	0.00405	
2695	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	5460	NDC	0.00673	
2738	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	5460	NDC	0.00459	
2802	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	5460	NDC	0.00502	
2944	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	4950	NDC	0.00577	
3057	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	4950	NDC	0.00657	
3275	OCTA-CDF	442/444 (87/100)	442+444	2.192	10747	NDC	0.0209	
1890	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	11706	NDC	0.00918	
2423	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	16496	NDC	0.0177	
2749	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	6237	NDC	0.0103	
2759	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	6237	NDC	0.0139	
2786	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	6237	NDC	0.00818	
3026	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	4975	NDC	0.00721	
3270	OCTA-CDD	458/460 (87/100)	458+460	2.044	4983		0.0104	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: DATE: 3/12/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/8/88 REVIEWED: DATE: 3/12/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/8/88 REVIEWED:________ DATE:________

QA04516X

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X2
SAMPLE ID: QA 04516 (FILTER)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 2.35 ng
13C-1,2,3,7,8,9-HxCDD 4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF 1.20 NG
13C-1,2,3,7,8-PeCDF 2.45 NG
13C-1,2,3,4,7,8-HxCDF 4.95 NG
13C-1,2,3,4,6,7,8-HpCDF 4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD 1.25 NG
13C-1,2,3,7,8-PeCDD 2.48 NG
13C-1,2,3,6,7,8-HxCDD 4.90 NG
13C-1,2,3,4,6,7,8-HpCDD 4.90 NG
13C-OCDD 12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1864	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1854390	NA	2.35	NA
2786	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2952600	NA	4.90	NA
1792	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	843136	0.553		46.1
2297	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1257180	1.047		42.7
2676	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2072190	2.323		46.9
2945	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1470950	2.414		49.8
1891	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	650784	0.609		48.7
2423	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	816792	1.331		53.7
2759	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1609660	2.840		58.0
3026	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	1115360	2.969		60.6
3271	13C-OCDD	470/472 (87/100)	472	0.605	2873450	7.888		64.1
1794	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	713360		0.391	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	865155		0.74	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	3731600		3.98	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	1321636		1.83	
3281	OCTA-CDF	442/444 (87/100)	442+444	2.192	782328		1.53	
1893	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	444928		0.361	
2424	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	337577		0.352	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	2033356		2.66	
3026	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	511330		0.740	
3272	OCTA-CDD	458/460 (87/100)	458+460	2.044	806878		1.69	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: DATE: 3/21/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/15/88 REVIEWED: DATE: 3/21/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/15/88 REVIEWED:__________ DATE:________

QA04516X

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X2
SAMPLE ID: QA 04516 (FILTER)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 2.35 ng
13C-1,2,3,7,8,9-HxCDD 4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTD SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1794	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	713360		0.391	
2291	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.606	9494	NDK	0.00710	
2299	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.808	398572		0.430	
2383	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	461166		0.396	
2678	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	905344		0.929	
2688	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.444	1023920		1.001	
2698	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.586	9464	NDK	0.0143	
2741	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	959536		1.024	
2805	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	842800		0.984	
2947	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.386	810548		1.120	
3060	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.098	511088		0.803	
3278	OCTA-CDF	442/444 (87/100)	442+444	2.192	782328		1.53	
1893	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	444928		0.361	
2425	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	337577		0.352	
2751	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	659728		1.088	
2761	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	619288		1.37	
2788	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	754340		0.988	
3028	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.107	511330		0.723	
3273	OCTA-CDD	458/460 (87/100)	458+460	2.044	806878		1.69	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: Mike Milly DATE: 3/21/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/15/88 REVIEWED: Mike Milly DATE: 3/21/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/15/88 REVIEWED:__________ DATE:__________

QA04517X

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910!.02
GC/MS DATA FILE: 8910A30X3
SAMPLE ID: QA 04517 (FILTER)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1852	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1808150	NA	2.35	NA
2783	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	3141500	NA	4.90	NA
1781	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	835056	0.561		46.8
2290	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1632920	1.395		56.9
2671	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2669340	2.812		56.8
2942	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1805510	2.784		57.4
1879	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	603872	0.580		46.4
2418	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	854536	1.428		57.6
2756	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1716380	2.847		58.1
3023	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	1207930	3.022		61.2
3268	13C-OCDD	470/472 (87/100)	472	0.605	2865470	7.393		60.1
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	8684	NDK	0.00481	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	4949	NDK	0.00327	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	5232	NDK	0.00433	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	7425	NDK	0.00837	
NA	OCTA-CDF	442/444 (87/100)	442+444	2.192	17630	NDK	0.0345	
1568	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	15382	NDK	0.0135	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	9897	NDK	0.00986	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	6115	NDK	0.00751	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	7616	NDK	0.0102	
3243	OCTA-CDD	458/460 (87/100)	458+460	2.044	11902	NDK	0.0250	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: Mike Molloy DATE: 3/18/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/8/88 REVIEWED: Mike Molloy DATE: 3/18/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/8/88 REVIEWED:__________ DATE:________

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X3
SAMPLE ID: QA 04517 (FILTER)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1783	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	8898	NDK	0.00493	
2284	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	4949	NDK	0.00314	
2292	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	4949	NDK	0.00374	
2376	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	4949	NDK	0.00327	
2673	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	5232	NDK	0.00417	
2683	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	5232	NDK	0.00382	
2693	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	5232	NDK	0.00635	
2736	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	7562	NDK	0.00627	
2800	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	5387	NDK	0.00488	
2944	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	5717	NDK	0.00645	
3257	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	8291	NDK	0.0106	
3275	OCTA-CDF	442/444 (87/100)	442+444	2.192	17529	NDK	0.0343	
1881	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	15382	NDK	0.0134	
2420	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	8485	NDK	0.00845	
2748	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	5227	NDK	0.00809	
2758	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	5227	NDK	0.0109	
2785	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	5063	NDK	0.00622	
3025	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	7616	NDK	0.0102	
3270	OCTA-CDD	458/460 (87/100)	458+460	2.044	11902	NDK	0.0250	

GC/MS ANALYST: R. ROBSON   ANALYSIS DATE: 1/30/88   DATA ENTRY REVIEWED: Mike Miller DATE: 3/13/88

DATA ANALYST: M. WHITACRE   ANALYSIS DATE: 3/8/88   REVIEWED: Mike Miller DATE: 3/12/88

DATA ENTRY: M. WHITACRE   ENTRY DATE: 3/8/88   REVIEWED: ____________ DATE: ________

QA04518X

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X4
SAMPLE ID: QA 04518 (XAD/FILTER)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1856	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1320070	NA	2.35	NA
2785	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2072350	NA	4.90	NA
1785	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	661300	0.609		50.7
2294	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1147690	1.343		54.8
2674	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	1985710	3.172		64.1
2944	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1244150	2.909		60.0
1884	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	423600	0.557		44.6
2421	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	590744	1.352		54.5
2758	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1212610	3.049		62.2
3025	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	771896	2.927		59.7
3269	13C-OCDD	470/472 (87/100)	472	0.605	1852120	7.243		58.9
1786	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	517395		0.362	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	705697		0.663	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	2950902		3.287	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	1024151		1.676	
3280	OCTA-CDF	442/444 (87/100)	442+444	2.192	556984		1.688	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	302448		0.377	
2422	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	238951		0.344	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	1442286		2.507	
3026	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	360708		0.754	
3270	OCTA-CDD	458/460 (87/100)	458+460	2.044	533951		1.735	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: DATE: 3/18/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/8/88 REVIEWED: DATE: 3/18/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/8/88 REVIEWED:__________ DATE:________

QA04518X

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X4
SAMPLE ID: QA 04518 (XAD/FILTER)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1787	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	518395		0.363	
2288	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	9897	ND<	0.009	
2296	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	332891		0.358	
2380	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	372806		0.3503	
2676	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	811760		0.869	
2686	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	823944		0.8097	
2696	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	15925	ND<	0.026	
2739	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	729304		0.812	
2803	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	585894		0.714	
2946	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	593388		0.971	
3059	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	430763		0.801	
3276	OCTA-CDF	442/444 (87/100)	442+444	2.192	561385		1.701	
1886	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	302448		0.377	
2423	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	238951		0.344	
2750	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	444316		0.972	
2760	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	497184		1.464	
2787	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	500786		0.8705	
3027	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	360708		0.754	
3271	OCTA-CDD	458/460 (87/100)	458+460	2.044	533951		1.735	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: Mike Kelly DATE: 3/18/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/8/88 REVIEWED: Mike Kelly DATE: 3/18/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/8/88 REVIEWED:__________ DATE:________

QA04519X

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30XS
SAMPLE ID: QA 04519 (XAD/FILTER)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1855	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1657560	NA	2.35	NA
2783	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2702110	NA	4.90	NA
1783	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	790752	0.580		48.3
2292	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1488230	1.387		56.6
2672	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2428190	2.974		60.1
2942	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1647880	2.955		60.9
1883	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	504080	0.528		42.2
2418	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	722456	1.317		53.1
2756	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1521450	2.934		59.9
3023	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	1050510	3.055		62.4
3268	13C-OCDD	470/472 (87/100)	472	0.605	2626070	7.877		64.0
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	6947	ND<	0.00406	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	6598	ND<	0.00478	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	4550	ND<	0.00414	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	7627	ND<	0.00942	
NA	OCTA-CDF	442/444 (87/100)	442+444	2.192	6749	ND<	0.0144	
1594	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	10409	ND<	0.0109	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	9897	ND<	0.0117	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	6825	ND<	0.00946	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	8995	ND<	0.0138	
3269	OCTA-CDD	458/460 (87/100)	458+460	2.044	11861		0.0272	

GC/MS ANALYST: R. ROBSON
ANALYSIS DATE: 1/30/88
DATA ENTRY REVIEWED: Mike Milly DATE: 3/18/88

DATA ANALYST: M. WHITACRE
ANALYSIS DATE: 3/8/88
REVIEWED: Mike Milly DATE: 3/18/88

DATA ENTRY: M. WHITACRE
ENTRY DATE: 3/8/88
REVIEWED: ________ DATE: ________

QA04519X

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30XS
SAMPLE ID: QA 04519 (XAD/FILTER)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 2.35 ng
13C-1,2,3,7,8,9-HxCDD 4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF 1.24 NG
13C-1,2,3,7,8-PeCDF 2.45 NG
13C-1,2,3,4,7,8-HxCDF 4.95 NG
13C-1,2,3,4,6,7,8-HpCDF 4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD 1.25 NG
13C-1,2,3,7,8-PeCDD 2.48 NG
13C-1,2,3,6,7,8-HxCDD 4.90 NG
13C-1,2,3,4,6,7,8-HpCDD 4.90 NG
13C-OCDD 12.3 NG

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1785	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	6767	NDK	0.00396	
2286	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	6598	NDK	0.00460	
2294	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	6598	NDK	0.00546	
2378	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	6598	NDK	0.00478	
2674	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	4550	NDK	0.00399	
2684	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	4550	NDK	0.00366	
2694	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	4550	NDK	0.00607	
2737	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	4550	NDK	0.00414	
2801	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	4550	NDK	0.00453	
2944	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	7627	NDK	0.00942	
3057	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	7627	NDK	0.0107	
3275	OCTA-CDF	442/444 (87/100)	442+444	2.192	6749	NDK	0.0144	
1885	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	10409	NDK	0.0109	
2420	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	9897	NDK	0.0117	
2748	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	9650	NDK	0.0168	
2758	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	9650	NDK	0.0226	
2785	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	6629	NDK	0.00918	
3025	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	8995	NDK	0.0138	
3270	OCTA-CDD	458/460 (87/100)	458+460	2.044	11861		0.0272	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: DATE: 3/9/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/8/88 REVIEWED: DATE: 3/12/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/8/88 REVIEWED: ____________ DATE: ________

L.4 PCDD/PCDF Relative Response Factors

TABLE L-7. RESPONSE FACTOR COMPARISON TABLE FOR TOTAL TETRA-OCTA CDD/CDF

Response Factor (RRF) = [Area(S)/Area(IS)] • [Conc.(IS)/Conc.(S)]

Date analyzed: Standard conc.: Data file no.: Area R.I.S 1: Area R.I.S 2:	1/28/88 Average response factor	% RSD (RRF)	Range (RRF) -20%	Range (RRF) +20%	1/29/88 DF100 A29XQ6 804768 1557430	1/30/88 DF100 A30XQ2 608768 1172410	1/30/88 DF100 A30XQ3 956800 1947610	1/31/88 DF100 A31XQ2 800192 1512190	1/31/88 DF100 A31XQ3 841816 1472290	3/18/88 DF100 C18XQ6 1016270 1888120	3/18/88 DF100 C18XQ7 1084380 2514200
^{13}C-1,2,3,4-TCDD	1.000	0.00	0.800	1.200	1.000	1.000	1.000	1.000	1.000	1.000	1.000
^{13}C-1,2,3,7,8,9-HxCDD	1.000	0.00	0.800	1.200	1.000	1.000	1.000	1.000	1.000	1.000	1.000
^{13}C-2,3,7,8-TCDF	1.934	10.63	1.547	2.320	1.932	1.818	1.845	1.753	1.805	1.864	1.958
^{13}C-1,2,3,7,8-PeCDF	1.521	14.97	1.217	1.825	1.852	1.663	1.790	1.743	1.555	1.361	1.620
^{13}C-1,2,3,6,7,8-HxCDF	1.480	6.49	1.184	1.776	1.501	1.578	1.534	1.500	1.515	1.500	1.420
^{13}C-1,2,3,4,6,7,8-HpCDF	1.011	3.57	0.809	1.214	1.013	1.038	0.999	0.992	1.026	1.029	1.072
^{13}C-2,3,7,8-TCDD	1.354	12.54	1.083	1.625	1.319	1.319	1.339	1.371	1.350	1.204	1.376
^{13}C-1,2,3,7,8-PeCDD	0.778	11.91	0.622	0.933	0.849	0.841	0.927	0.908	0.781	0.796	0.881
^{13}C-1,2,3,6,7,8-HxCDD	0.940	2.23	0.752	1.129	0.937	0.971	0.923	0.954	0.940	0.993	0.915
^{13}C-1,2,3,4,6,7,8-HpCDD	0.624	3.95	0.499	0.748	0.630	0.672	0.666	0.599	0.657	0.634	0.654
^{13}C-OCDD	0.605	11.65	0.484	0.725	0.617	0.698	0.709	0.537	0.654	0.714	0.781
Total tetra-CDF	2.594	9.50	2.075	3.113	2.643	2.636	2.622	2.681	2.701	2.724	2.605
Total penta-CDF	2.273	15.37	1.818	2.727	1.967	2.166	2.084	2.174	2.185	2.485	2.320
Total hexa-CDF	2.238	6.61	1.791	2.686	2.144	2.069	2.039	2.121	2.110	2.146	2.214
Total hepta-CDF	2.383	4.18	1.906	2.859	2.397	2.384	2.396	2.335	2.395	2.265	2.276
Octa-CDF	2.192	1.12	1.753	2.630	2.131	2.109	1.936	2.109	2.158	1.985	2.025
Total tetra-CDD	2.367	6.71	1.893	2.840	2.498	2.508	2.412	2.702	2.343	2.828	2.388
Total penta-CDD	2.914	3.05	2.331	3.496	3.006	2.925	2.768	2.870	2.986	2.882	2.859
Total hexa-CDD	2.325	12.57	1.860	2.790	2.623	2.640	2.611	2.505	2.450	2.488	2.666
Total hepta-CDD	3.036	5.61	2.429	3.644	3.016	2.996	2.972	3.048	3.007	3.022	3.094
Octa-CDD	2.044	5.66	1.635	2.453	2.009	1.999	1.907	2.022	2.016	1.880	1.900

TABLE L-8. RESPONSE FACTOR COMPARISON TABLE FOR SPECIFIC TETRA-OCTA CDD/CDF

Response Factor (RRF) = [Area(S)/Area(IS)] • [Conc.(IS)/Conc.(S)]

Date analyzed:					1/29/88	1/30/88	1/30/88	1/31/88	1/31/88	3/18/88	3/18/88
Standard conc.:	1/28/88				DF100	DF100	DF100	DF100	DF100	DF100	DF100
Data file no.:	Average		Range	Range	A29XQ6	A30XQ2	A30XQ3	A31XQ2	A31XQ3	C18XQ6	C18XQ7
Area R.I.S 1:	response	% RSD	(RRF)	(RRF)	804768	608768	956800	800192	841816	1016270	1084380
Area R.I.S 2:	factor	(RRF)	-20%	+20%	1557430	1172410	1947610	1512190	1472290	1888120	2514200
2,3,7,8-Tetra-CDF	2.594	9.50	2.075	3.113	2.643	2.560	2.622	2.681	2.701	2.724	2.605
1,2,3,4,8-Penta-CDF	2.362	10.36	1.890	2.835	2.186	2.241	2.281	2.228	2.225	2.620	2.395
1,2,3,7,8-Penta-CDF	1.988	18.49	1.590	2.385	1.620	1.812	1.739	1.834	1.875	2.046	1.898
2,3,4,7,8-Penta-CDF	2.272	15.32	1.817	2.726	1.967	2.166	2.084	2.174	2.185	2.485	2.320
1,2,3,4,7,8-Hexa-CDF	2.327	6.88	1.862	2.793	2.284	2.156	2.164	2.282	2.261	2.215	2.390
1,2,3,6,7,8-Hexa-CDF	2.537	6.82	2.029	3.044	2.452	2.314	2.392	2.446	2.434	2.522	2.519
1,2,3,4,7,9-Hexa-CDF	1.527	5.10	1.222	1.833	1.477	1.436	1.362	1.352	1.319	1.442	1.499
2,3,4,6,7,8-Hexa-CDF	2.238	6.61	1.791	2.686	2.144	2.069	2.039	2.121	2.110	2.146	2.214
1,2,3,7,8,9-Hexa-CDF	2.045	9.03	1.636	2.455	1.923	1.852	1.825	1.979	1.958	1.890	1.918
1,2,3,4,6,7,8-Hepta-CDF	2.383	4.18	1.906	2.859	2.397	2.384	2.396	2.335	2.395	2.265	2.276
1,2,3,4,7,8,9-Hepta-CDF	2.095	4.03	1.676	2.514	2.124	2.068	2.204	1.914	2.071	1.932	2.020
Octa-CDF	2.192	1.12	1.753	2.630	2.131	2.109	1.936	2.109	2.158	1.985	2.025
2,3,7,8-TCDD	2.367	6.71	1.894	2.841	2.498	2.508	2.412	2.702	2.343	2.828	2.388
1,2,3,7,8-Penta-CDD	2.914	3.05	2.331	3.496	3.006	2.925	2.768	2.870	2.986	2.882	2.859
1,2,3,4,7,8-Hexa-CDD	1.847	11.21	1.477	2.216	2.203	1.984	2.244	2.220	2.096	1.902	2.127
1,2,3,6,7,8-Hexa-CDD	1.372	19.39	1.098	1.647	1.550	1.663	1.496	1.414	1.316	1.549	1.485
1,2,3,7,8,9-Hexa-CDD	2.325	12.57	1.860	2.790	2.623	2.640	2.611	2.505	2.450	2.488	2.666
1,2,3,4,6,7,8-Hepta-CDD	3.036	5.61	2.429	3.644	3.016	2.996	2.972	3.048	3.007	3.022	3.094
Octa-CDD	2.044	5.66	1.635	2.453	2.009	1.999	1.907	2.022	2.016	1.880	1.900

5A29X01X

PAGE 1 : TOTAL ANALYSIS

STANDARD SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A29X01
SAMPLE ID: 980-75 DF5-25

RECOVERY INTERNAL STANDARDS (C13)

TCDD	93.1 pg/ul
HxCDD	194 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.5 PG/UL
13C-1,2,3,7,8-PeCDF	97.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	196 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	192 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.5 PG/UL
13C-1,2,3,7,8-PeCDD	98.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	194 PG/UL
13C-OCDD	485 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1839	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	93.1	815840	0.81	1	
2757	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	194	1278700	0.80	2	
1769	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.869	47.5	778016	0.80	3	1
2269	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.642	97.0	1396048	0.61	4	1
2646	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.615	196	2086510	0.79	5	2
2916	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.002	192	1268460	0.95	6	2
1867	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.334	49.5	578826	0.86	7	1
2394	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.707	98.0	607124	0.65	8	1
2730	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.946	194	1210110	0.79	9	2
2999	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.582	194	744304	0.95	10	2
3243	13C-OCDD	470/472 (87/100)	472	0.542	485	1732780	0.94	11	2
1770	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.916	4.88	233083	0.77		3
2356	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	1.911	4.86	133676	0.60		4
2709	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.088	12.4	275618	0.83		5
2918	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.502	12.2	201646	0.92		6
3252	OCTA-CDF	442/444 (87/100)	442+444	2.201	23.9	187969	0.92		11
1869	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.536	4.81	142660	0.95		7
2396	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	3.030	4.91	92158	0.58		8
2758	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.746	12.3	210678	0.82		9
2999	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.173	12.1	147321	0.92		10
3244	OCTA-CDD	458/460 (87/100)	458+460	2.175	23.7	184149	0.87		11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/29/88 DATA ENTRY REVIEWED: DATE: 3/13/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/18/88 REVIEWED: DATE: 3/13/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 2/18/88 REVIEWED:__________ DATE:_______

5A29X01X

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

STANDARD SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A29X01
SAMPLE ID: 980-75 DF5-25

RECOVERY INTERNAL STANDARDS (C13)

TCDD 53.1 pg/ul
HxCDD 194 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.5 PG/UL
13C-1,2,3,7,8-PeCDF	97.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	196 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	192 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.5 PG/UL
13C-1,2,3,7,8-PeCDD	98.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	194 PG/UL
13C-OCDD	485 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1770	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.916	4.88	233083	0.77	12	3
2263	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	1.980	5.54	157849	0.64	13	4
2272	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.748	4.86	122288	0.68	14	4
2356	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.911	4.86	133676	0.60	15	4
2647	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.256	12.0	288163	0.81	16	5
2657	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.468	12.1	317840	0.79	17	5
2666	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.411	12.7	190760	0.80	18	5
2709	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.088	12.4	275618	0.83	19	5
2774	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	1.851	12.0	236425	0.82	20	5
2918	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.502	12.2	201646	0.92	21	6
3029	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.047	12.3	166360	0.98	22	6
3252	OCTA-CDF	442/444 (87/100)	442+444	2.201	23.9	187969	0.92	23	11
1869	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.536	4.81	142660	0.95	24	7
2396	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	3.030	4.91	92158	0.58	25	8
2723	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	2.107	11.9	156408	0.76	26	9
2731	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.739	12.3	133398	0.79	27	9
2758	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.746	12.3	210678	0.82	28	9
2999	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.173	12.1	147321	0.92	29	10
3244	OCTA-CDD	458/460 (87/100)	458+460	2.175	23.7	184149	0.87	30	11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/29/88 DATA ENTRY REVIEWED: Mike Mally DATE: 3/18/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/18/88 REVIEWED: Mike Mally DATE: 3/18/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 2/18/88 REVIEWED:__________ DATE:________

10A28XQ5

PAGE 1 : TOTAL ANALYSIS

STANDARD SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 0984A28XQ5
SAMPLE ID: 980-75 DF10-50

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1864	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	92.1	1117240	0.92	1	
2783	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	192	1728590	0.78	2	
1792	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.691	47.1	966384	0.81	3	1
2296	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.216	96.0	1416090	0.63	4	1
2671	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.455	194	2540850	0.68	5	2
2943	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.058	190	1809830	0.95	6	2
1892	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.121	49.0	666560	0.80	7	1
2420	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.688	97.0	809512	0.64	8	1
2756	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.938	192	1620940	0.79	9	2
3025	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.670	192	1158300	0.91	10	2
3269	13C-OCDD	470/472 (87/100)	472	0.677	480	2925980	0.92	11	2
1794	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.422	9.66	480092	0.74		3
2381	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.568	9.60	363682	0.60		4
2735	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.305	24.4	736550	0.81		5
2944	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.377	23.9	541098	0.98		6
3279	OCTA-CDF	442/444 (87/100)	442+444	2.201	47.2	633326	1.06		11
1894	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.455	9.53	318252	0.75		7
2422	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.835	9.70	229464	0.56		8
2784	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.090	24.4	430614	0.91		9
3026	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	2.990	23.9	431060	1.00		10
3274	OCTA-CDD	458/460 (87/100)	458+460	2.059	46.8	587448	0.84		11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/28/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/16/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 2/16/88

DATA ENTRY REVIEWED: DATE: 3/18/88
REVIEWED: DATE: 3/19/88
REVIEWED:__________ DATE:________

10A28XQ5

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

STANDARD SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO:	8910L02-14
GC/MS DATA FILE:	8984A28XQ5
SAMPLE ID:	980-75 0F10-50

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	488 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1794	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.422	9.66	480092	0.82	12	3
2290	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.539	11.0	412036	0.66	13	4
2297	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.325	9.60	329276	0.55	14	4
2381	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.563	9.62	363682	0.60	15	4
2673	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.397	23.6	741036	0.80	16	5
2682	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.636	23.9	825056	0.81	17	5
2692	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.582	25.2	522028	0.76	18	5
2735	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.305	24.4	736550	0.81	19	5
2800	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.100	23.6	648948	0.81	20	5
2944	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.377	23.9	541098	0.98	21	6
3056	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.048	24.3	474126	0.94	22	6
3279	OCTA-CDF	442/444 (87/100)	442+444	2.201	47.2	633326	1.06	23	11
1894	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.457	9.52	318252	0.75	24	7
2422	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.835	9.70	229464	0.56	25	8
2749	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.601	23.4	316344	0.97	26	9
2757	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.146	24.4	236150	0.87	27	9
2784	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.090	24.4	430614	0.91	28	9
3026	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	2.990	23.9	431060	1.00	29	10
3274	OCTA-CDD	458/460 (87/100)	458+460	2.059	46.8	587448	0.84	30	11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/28/88 DATA ENTRY REVIEWED:__________ DATE:________

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/16/88 REVIEWED:__________ DATE:________

DATA ENTRY: M. WHITACRE ENTRY DATE: 2/16/88 REVIEWED:__________ DATE:________

1002BX04

PAGE 1 : TOTAL ANALYSIS

STANDARD SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8904A28X04
SAMPLE ID: 980-75 OF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1878	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	92.1	892768	0.80	1	
2787	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	192	1723890	0.78	2	
1806	13C-2,3,7,8-TCDF	316/318 (76/100)	316	2.045	47.1	933576	0.85	3	1
2305	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.487	96.0	1384070	0.65	4	1
2677	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.388	194	2416860	0.74	5	2
2947	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.009	190	1721890	0.95	6	2
1906	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.471	49.0	698528	0.89	7	1
2427	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.852	97.0	801560	0.64	8	1
2761	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.914	192	1575070	0.79	9	2
3029	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.640	192	1103110	0.91	10	2
3273	13C-OCDD	470/472 (87/100)	472	0.653	480	2813560	0.92	11	2
1808	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.559	96.6	4899920	0.82		3
2389	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.577	96.2	3573980	0.61		4
2740	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.412	244	7333020	0.81		5
2948	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.405	239	5209920	0.93		6
3283	OCTA-CDF	442/444 (87/100)	442+444	2.209	472	6110420	0.90		11
1907	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.186	95.3	2969190	0.76		7
2429	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.938	97.0	2354828	0.60		8
2788	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.288	244	4579950	0.91		9
3030	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.118	239	4281250	0.96		10
3274	OCTA-CDD	458/460 (87/100)	458+460	2.048	468	5618650	0.89		11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/28/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/16/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 2/16/88

DATA ENTRY REVIEWED: DATE: 3/18/88
REVIEWED: DATE: 3/18/88
REVIEWED:__________ DATE:________

10028X04

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

STANDARD SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8984A28X04
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST-#
1808	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.559	96.6	4899920	0.82	12	3
2298	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.589	110	4105660	0.60	13	4
2306	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.159	96.0	2987700	0.59	14	4
2389	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.577	96.2	3573980	0.61	15	4
2678	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.511	236	7382270	0.80	16	5
2688	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.650	239	7890550	0.80	17	5
2697	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.626	252	5104980	0.81	18	5
2740	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.412	244	7333020	0.81	19	5
2804	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.276	236	6692860	0.80	20	5
2948	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.405	239	5209920	0.95	21	6
3059	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.224	243	4897620	0.93	22	6
3283	OCTA-CDF	442/444 (87/100)	442+444	2.209	472	6110420	0.90	23	11
1907	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.186	95.3	2969190	0.76	24	7
2429	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.938	97.0	2354828	0.60	25	8
2754	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.826	234	3504640	0.89	26	9
2762	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.395	244	2792880	0.89	27	9
2788	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.288	244	4579950	0.91	28	9
3030	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.118	239	4281250	0.96	29	10
3274	OCTA-CDD	458/460 (87/100)	458+460	2.048	468	5618650	0.89	30	11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/28/88 DATA ENTRY REVIEWED: Mike Mully DATE: 3/18/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/16/88 REVIEWED: Mike Mully DATE: 3/18/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 2/16/88 REVIEWED:__________ DATE:________

S0028X06

PAGE 1 : TOTAL ANALYSIS

STANDARD SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8984A28X06
SAMPLE ID: 980-75 OF500-2500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	85.5 pg/ul
HxCDD	178 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	43.6 PG/UL
13C-1,2,3,7,8-PeCDF	89.1 PG/UL
13C-1,2,3,4,7,8-HxCDF	180 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	176 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	45.5 PG/UL
13C-1,2,3,7,8-PeCDD	90.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	178 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	178 PG/UL
13C-OCDD	446 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1865	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	85.5	879781	0.74	1	
2781	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	178	1728570	0.76	2	
1793	13C-2,3,7,8-TCDF	316/318 (76/100)	316	2.129	43.6	955184	0.80	3	1
2295	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.739	89.1	1594330	0.64	4	1
2670	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.464	180	2559350	0.78	5	2
2941	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	0.976	176	1668700	0.94	6	2
1892	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.409	45.5	697365	0.84	7	1
2419	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.863	90.0	798824	0.63	8	1
2754	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.964	178	1666510	0.76	9	2
3023	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.602	178	1040760	0.92	10	2
3269	13C-OCDD	470/472 (87/100)	472	0.546	446	2366390	0.92	11	2
1795	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.478	449	24376100	0.80		3
2380	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.034	447	16269620	0.66		4
2733	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.148	1131	34534900	0.80		5
2942	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.247	1111	23665200	0.96		6
3279	OCTA-CDF	442/444 (87/100)	442+444	2.155	2193	25074800	0.91		11
1894	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.291	442	15516860	0.74		7
2420	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.852	451	11417750	0.60		8
2782	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.175	1131	23025800	0.84		9
3024	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	2.864	1109	18573680	0.94		10
3269	OCTA-CDD	458/460 (87/100)	458+460	1.893	2178	21874300	0.90		11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/28/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/17/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 2/17/88

DATA ENTRY REVIEWED: Mike Kelly DATE: 3/18/88

REVIEWED: Mike Kelly DATE: 3/18/88

REVIEWED:__________ DATE:_______

50028X06

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

STANDARD SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8984A28X06
SAMPLE ID: 980-75 DF500-2500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	85.5 pg/ul
HxCDD	178 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	43.6 PG/UL
13C-1,2,3,7,8-PeCDF	89.1 PG/UL
13C-1,2,3,4,7,8-HxCDF	180 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	176 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	45.5 PG/UL
13C-1,2,3,7,8-PeCDD	90.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	178 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	178 PG/UL
13C-OCDD	446 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST-#
1795	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.478	449	24376100	0.80	12	3
2288	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.341	509	21325020	0.63	13	4
2297	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.719	447	13745910	0.64	14	4
2380	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.034	447	16269620	0.66	15	4
2671	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.145	1101	33581200	0.80	16	5
2681	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.392	1111	37793700	0.80	17	5
2691	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.490	1169	24764300	0.80	18	5
2733	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.148	1131	34534900	0.80	19	5
2798	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	1.955	1097	30497300	0.80	20	5
2942	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.247	1111	23665200	0.96	21	6
3053	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.062	1127	22035600	0.93	22	6
3279	OCTA-CDF	442/444 (87/100)	442+444	2.155	2193	25074800	0.91	23	11
1894	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.291	442	15516860	0.74	24	7
2420	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.[illegible]52	451	11417750	0.60	25	8
2748	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.853	1087	18853040	0.86	26	9
2755	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.209	1131	12797680	0.85	27	9
2782	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.175	1131	23025800	0.84	28	9
3024	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	2.864	1109	18573680	0.94	29	10
3269	OCTA-CDD	458/460 (87/100)	458+460	1.893	2178	21874300	0.90	30	11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/28/88 DATA ENTRY REVIEWED: DATE: 3/18/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/17/88 REVIEWED: DATE: 3/18/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 2/17/88 REVIEWED:__________ DATE:________

10029X06

PAGE 1 : TOTAL ANALYSIS

STANDARD SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A29X06
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1833	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	92.1	804768	0.79	1	
2755	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	192	1557430	0.77	2	
1763	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.990	47.1	818976	0.81	3	1
2266	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.852	96.0	1553300	0.62	4	1
2644	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.501	194	2362430	0.78	5	2
2916	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.013	190	1560940	0.95	6	2
1860	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.319	49.0	564592	0.79	7	1
2391	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.849	97.0	719424	0.63	8	1
2729	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.937	192	1458860	0.79	9	2
2998	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.630	192	980908	0.92	10	2
3243	13C-OCDD	470/472 (87/100)	472	0.617	480	2404190	0.94	11	2
1764	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.567	96.6	4312050	0.80		3
2352	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	1.967	96.2	3061040	0.65		4
2707	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.144	244	6370000	0.81		5
2917	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.397	239	4705780	0.97		6
3253	OCTA-CDF	442/444 (87/100)	442+444	2.131	472	5038650	0.89		11
1862	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.498	95.3	2742770	0.78		7
2393	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	3.006	97.0	2162426	0.61		8
2756	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.623	244	4063090	0.77		9
2999	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.016	239	3682860	0.97		10
3244	OCTA-CDD	458/460 (87/100)	458+460	2.009	468	4709720	0.88		11

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 1/29/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/29/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 2/29/88

DATA ENTRY REVIEWED: Mike Malloy DATE: 3/18/88
REVIEWED: Mike Malloy DATE: 3/18/88
REVIEWED:__________ DATE:________

10029X06

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

STANDARD SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A29X06
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1764	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.567	96.6	4312050	0.80	12	3
2259	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.186	110	3891320	0.65	13	4
2267	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.620	96.0	2516822	0.64	14	4
2352	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.967	96.2	3061040	0.65	15	4
2645	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.284	236	6565360	0.83	16	5
2655	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.452	239	7137140	0.81	17	5
2665	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.477	252	4533590	0.79	18	5
2707	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.144	244	6370000	0.81	19	5
2773	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	1.923	236	5525460	0.79	20	5
2917	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.397	239	4705780	0.97	21	6
3028	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.124	243	4241050	0.98	22	6
3253	OCTA-CDF	442/444 (87/100)	442+444	2.131	472	5038650	0.89	23	11
1862	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.498	95.3	2742770	0.78	24	7
2393	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	3.006	97.0	2162426	0.61	25	8
2722	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	2.203	234	3917650	0.79	26	9
2730	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.550	244	2873200	0.79	27	9
2756	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.623	244	4863090	0.77	28	9
2999	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.016	239	3682860	0.97	29	10
3244	OCTA-CDD	458/460 (87/100)	458+460	2.009	468	4709720	0.88	30	11

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 1/29/88 DATA ENTRY REVIEWED: Mike Mulling DATE: 3/18/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/29/88 REVIEWED: Mike Mulling DATE: 3/18/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 2/29/88 REVIEWED:__________ DATE:_______

10030XQ2

PAGE 1 : TOTAL ANALYSIS

STANDARD SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A30XQ2
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1859	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	92.1	608768	0.78	1	
2783	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	192	1172410	0.81	2	
1788	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.872	47.1	582696	0.82	3	1
2294	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.663	96.0	1055080	0.64	4	1
2672	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.578	194	1869420	0.77	5	2
2942	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.038	190	1203810	0.95	6	2
1887	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.319	49.0	427330	0.78	7	1
2420	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.841	97.0	539088	0.67	8	1
2757	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.971	192	1138520	0.78	9	2
3022	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.672	192	788248	0.93	10	2
3267	13C-OCDD	470/472 (87/100)	472	0.698	480	2045880	0.90	11	2
1790	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.560	96.6	3059100	0.78		3
2381	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.166	96.2	2289932	0.63		4
2700	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.069	244	4865360	0.81		5
2942	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.384	239	3610370	0.97		6
3277	OCTA-CDF	442/444 (87/100)	442+444	2.109	472	4243800	0.91		11
1890	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.508	95.3	2084264	0.78		7
2421	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.925	97.0	1576928	0.60		8
2784	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.640	244	3820270	0.79		9
3023	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	2.996	239	2939280	0.97		10
3268	OCTA-CDD	458/460 (87/100)	458+460	1.999	468	3987250	0.90		11

GC/MS ANALYST:	R. ROBSON	ANALYSIS DATE:	1/30/88	DATA ENTRY REVIEWED:____________	DATE:________
DATA ANALYST:	M. WHITACRE	ANALYSIS DATE:	2/29/88	REVIEWED:____________	DATE:________
DATA ENTRY:	M. WHITACRE	ENTRY DATE:	2/29/88	REVIEWED:____________	DATE:________

10030XQ2

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

STANDARD SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A30XQ2
SAMPLE ID: 980-75 OF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1790	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.560	96.6	3059100	0.78	12	3
2287	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.241	110	2709710	0.66	13	4
2295	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.812	96.0	1911374	0.56	14	4
2381	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.166	96.2	2289932	0.63	15	4
2674	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.156	236	4903390	0.81	16	5
2683	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.314	239	5330360	0.82	17	5
2693	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.436	252	3487770	0.82	18	5
2736	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.069	244	4865360	0.81	19	5
2800	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	1.852	236	4211590	0.80	20	5
2942	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.384	239	3610370	0.97	21	6
3053	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.068	243	3183790	0.95	22	6
3277	OCTA-CDF	442/444 (87/100)	442+444	2.109	472	4243800	0.91	23	11
1890	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.508	95.3	2084264	0.78	24	7
2421	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.925	97.0	1576928	0.60	25	8
2750	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.984	234	2752750	0.79	26	9
2758	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.663	244	2406230	0.79	27	9
2784	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.640	244	3820270	0.79	28	9
3023	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	2.996	239	2939280	0.97	29	10
3268	OCTA-CDD	458/460 (87/100)	458+460	1.999	468	3987250	0.90	30	11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED:____________DATE:_________

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/29/88 REVIEWED:____________DATE:_________

DATA ENTRY: M. WHITACRE ENTRY DATE: 2/29/88 REVIEWED:____________DATE:_________

10030XQ3

PAGE 1 : TOTAL ANALYSIS

STANDARD SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A30XQ3
SAMPLE ID: 980-75 DF[illegible]-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST # -
1853	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	92.1	956800	0.74	1	
2782	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	192	1947510	0.77	2	
1781	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.900	47.1	929464	0.82	3	1
2290	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.790	96.0	1784730	0.65	4	1
2671	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.534	194	3017880	0.80	5	2
2942	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	0.999	190	1924840	0.96	6	2
1880	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.339	49.0	681738	0.76	7	1
2417	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.927	97.0	934381	0.61	8	1
2756	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.923	192	1797340	0.80	9	2
3023	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.666	192	1296490	0.91	10	2
3266	13C-OCDD	470/472 (87/100)	472	0.709	480	3453080	0.87	11	2
1783	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.547	96.6	4854610	0.78		3
2377	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.084	96.2	3726710	0.62		4
2734	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.039	244	7737970	0.82		5
2943	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.396	239	5800500	0.98		6
3276	OCTA-CDF	442/444 (87/100)	442+444	1.936	472	6573420	0.90		11
1882	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.412	95.3	3197750	0.78		7
2419	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.768	97.0	2586830	0.61		8
2783	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.611	244	5964090	0.80		9
3024	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	2.972	239	4796530	0.96		10
3267	OCTA-CDD	458/460 (87/100)	458+460	1.907	468	6419860	0.90		11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED:__________ DATE:______

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/29/88 REVIEWED:__________ DATE:______

DATA ENTRY: M. WHITACRE ENTRY DATE: 2/29/88 REVIEWED:__________ DATE:______

10030XQ3

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

STANDARD SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF STANDARDS

* RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A30XQ3
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1783	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.547	96.6	4054610	0.78	12	3
2283	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.281	110	4665650	0.62	13	4
2291	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.739	96.0	3104340	0.60	14	4
2377	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.084	96.2	3726710	0.62	15	4
2672	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.164	236	7942830	0.81	16	5
2682	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.392	239	8894330	0.80	17	5
2692	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.362	252	5339570	0.79	18	5
2734	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.039	244	7737970	0.82	19	5
2799	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	1.825	236	6701140	0.80	20	5
2943	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.396	239	5800500	0.98	21	6
3052	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.204	243	5424730	0.95	22	6
3276	OCTA-CDF	442/444 (87/100)	442+444	1.936	472	6573420	0.90	23	11
1802	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.412	95.3	3197750	0.78	24	7
2419	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.768	97.0	2586830	0.61	25	8
2748	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	2.244	234	4915940	0.77	26	9
2756	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.496	244	3417000	0.84	27	9
2783	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.611	244	5964090	0.80	28	9
3024	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	2.972	239	4796530	0.96	29	10
3267	OCTA-CDD	458/460 (87/100)	458+460	1.907	468	6419860	0.90	30	11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED:__________ DATE:________

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/29/88 REVIEWED:__________ DATE:________

DATA ENTRY: M. WHITACRE ENTRY DATE: 2/29/88 REVIEWED:__________ DATE:________

10031X02

PAGE 1 : TOTAL ANALYSIS

STANDARD SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A31X02
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1827	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	92.1	800192	0.73	1	
2756	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	192	1512190	0.77	2	
1756	13C-2,3,7,8-TCDF	316/318 (76/100)	316	2.057	47.1	811792	0.80	3	1
2263	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.743	96.0	1451020	0.63	4	1
2644	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.500	194	2291740	0.80	5	2
2917	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	0.992	190	1484780	0.92	6	2
1853	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.371	49.0	583504	0.72	7	1
2390	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.908	97.0	765144	0.63	8	1
2729	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.954	192	1442760	0.82	9	2
3001	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.599	192	906544	0.93	10	2
3246	13C-OCDD	470/472 (87/100)	472	0.537	480	2029310	0.92	11	2
1757	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.604	96.6	4195090	0.77		3
2350	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.174	96.2	3167470	0.64		4
2708	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.121	244	6114290	0.80		5
2918	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.335	239	4361940	0.95		6
3255	OCTA-CDF	442/444 (87/100)	442+444	2.109	472	4209440	0.93		11
1055	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.702	95.3	3065860	0.79		7
2391	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.870	97.0	2196162	0.62		8
2757	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.505	244	4592560	0.82		9
3001	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.048	239	3439070	0.96		10
3247	OCTA-CDD	458/460 (87/100)	458+460	2.022	468	4000310	0.89		11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED:____________ DATE:________

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/29/88 REVIEWED:____________ DATE:________

DATA ENTRY: M. WHITACRE ENTRY DATE: 2/29/88 REVIEWED:____________ DATE:________

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

STANDARD SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A31X02
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	400 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST:#
1757	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.604	96.6	4495090	0.77	12	3
2255	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.228	110	3712420	0.66	13	4
2264	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.834	96.0	2666180	0.65	14	4
2350	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.174	96.2	3167470	0.64	15	4
2645	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.282	236	6362870	0.77	16	5
2656	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.446	239	6905590	0.85	17	5
2665	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.352	252	4024790	0.80	18	5
2708	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.121	244	6114290	0.80	19	5
2773	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	1.979	236	5517780	0.80	20	5
2918	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.335	239	4361940	0.95	21	6
3031	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	1.914	243	3634280	0.95	22	6
3255	OCTA-CDF	442/444 (87/100)	442+444	2.109	472	4209440	0.93	23	11
1855	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.702	95.3	3065860	0.79	24	7
2391	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.870	97.0	2196162	0.62	25	8
2722	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	2.220	234	3903860	0.82	26	9
2730	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.414	244	2591730	0.82	27	9
2757	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.505	244	4592560	0.82	28	9
3001	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.048	239	3439070	0.96	29	10
3247	OCTA-CDD	458/460 (87/100)	458+460	2.022	468	4000310	0.89	30	11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED:__________ DATE:________

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/29/88 REVIEWED:__________ DATE:________

DATA ENTRY: M. WHITACRE ENTRY DATE: 2/29/88 REVIEWED:__________ DATE:________

10031X03

PAGE 1 : TOTAL ANALYSIS

STANDARD SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A31X03
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1823	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	92.1	841816	0.82	1	
2753	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	192	1472290	0.78	2	
1753	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.805	47.1	777168	0.78	3	1
2260	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.555	96.0	1364160	0.64	4	1
2641	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.515	194	2253100	0.78	5	2
2914	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.026	190	1494910	0.98	6	2
1850	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.350	49.0	604800	0.79	7	1
2387	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.781	97.0	692456	0.65	8	1
2726	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.948	192	1383550	0.77	9	2
2997	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.657	192	967624	0.93	10	2
3242	13C-OCDD	470/472 (87/100)	472	0.654	480	2406170	0.92	11	2
1755	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.623	96.6	4181010	0.79		3
2347	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.185	96.2	2987170	0.62		4
2704	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.110	244	5979960	0.81		5
2915	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.395	239	4503470	0.96		6
3252	OCTA-CDF	442/444 (87/100)	442+444	2.158	472	5105080	0.83		11
1853	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.343	95.3	2755890	0.81		7
2388	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.986	97.0	2067678	0.61		8
2754	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.450	244	4307590	0.82		9
2998	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.007	239	3622200	0.94		10
3244	OCTA-CDD	458/460 (87/100)	458+460	2.016	468	4728630	0.89		11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED:____________ DATE:________

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/29/88 REVIEWED:____________ DATE:________

DATA ENTRY: M. WHITACRE ENTRY DATE: 2/29/88 REVIEWED:____________ DATE:________

10031XQ3

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

STANDARD SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910A31XQ3
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1755	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.623	96.6	4181010	0.79	12	3
2253	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.225	110	3477770	0.63	13	4
2261	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.875	96.0	2557694	0.62	14	4
2347	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.185	96.2	2987170	0.62	15	4
2642	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.261	236	6198100	0.80	16	5
2652	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.434	239	6757370	0.82	17	5
2662	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.319	252	3859500	0.82	18	5
2704	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.110	244	5979960	0.81	19	5
2770	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	1.958	236	5367570	0.81	20	5
2915	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.395	239	4503470	0.96	21	6
3028	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.071	243	3959120	0.97	22	6
3252	OCTA-CDF	442/444 (87/100)	442+444	2.158	472	5105080	0.83	23	11
1853	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.343	95.3	2755890	0.81	24	7
2388	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.986	97.0	2067678	0.61	25	8
2719	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	2.096	234	3533460	0.83	26	9
2727	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.316	244	2313750	0.83	27	9
2754	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.450	244	4307590	0.82	28	9
2998	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.007	239	3622200	0.94	29	10
3244	OCTA-CDD	458/460 (87/100)	458+460	2.016	468	4728630	0.89	30	11

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/31/88 DATA ENTRY REVIEWED:__________ DATE:________
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 2/29/88 REVIEWED:__________ DATE:________
DATA ENTRY: M. WHITACRE ENTRY DATE: 2/29/88 REVIEWED:__________ DATE:________

10018X06

PAGE 1 : TOTAL ANALYSIS

STANDARD SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910C18X06
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1693	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	92.1	1016270	0.81	1	
2693	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	192	1888120	0.80	2	
1628	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.864	47.1	968896	0.76	3	1
2166	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.361	96.0	1442230	0.66	4	1
2577	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.500	194	2862390	0.80	5	2
2857	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.029	190	1923020	0.93	6	2
1717	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.204	49.0	650800	0.76	7	1
2307	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.796	97.0	852504	0.68	8	1
2666	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.993	192	1875830	0.78	9	2
2940	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.634	192	1197700	0.95	10	2
3171	13C-OCDD	470/472 (87/100)	472	0.714	480	3368120	0.88	11	2
1630	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.724	96.6	5413550	0.74		3
2263	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.485	96.2	3591750	0.60		4
2644	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.146	244	7726710	0.82		5
2858	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.265	239	5479110	0.96		6
3179	OCTA-CDF	442/444 (87/100)	442+444	1.985	472	6573200	0.87		11
1720	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.828	95.3	3579510	0.75		7
2308	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.882	97.0	2456708	0.59		8
2694	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.488	244	5931570	0.80		9
2941	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.022	239	4504960	0.97		10
3172	OCTA-CDD	458/460 (87/100)	458+460	1.880	468	6174180	0.89		11

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 3/18/88 DATA ENTRY REVIEWED:____________ DATE:________

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/22/88 REVIEWED:____________ DATE:________

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/22/88 REVIEWED:____________ DATE:________

10C18XQ6

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

STANDARD SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910C18XQ6
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1630	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.724	96.6	5413550	0.74	12	3
2158	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.620	110	4329620	0.58	13	4
2166	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.046	96.0	2951510	0.64	14	4
2262	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.465	96.2	3591750	0.60	15	4
2578	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.215	236	7711340	0.82	16	5
2588	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.522	239	8894070	0.81	17	5
2598	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.442	252	5359800	0.81	18	5
2644	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.146	244	7726710	0.82	19	5
2709	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	1.890	236	6579950	0.78	20	5
2858	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.265	239	5479110	0.96	21	6
2969	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	1.932	243	4750420	0.99	22	6
3179	OCTA-CDF	442/444 (87/100)	442+444	1.985	472	6573200	0.87	23	11
1720	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.828	95.3	3579510	0.75	24	7
2308	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.882	97.0	2456708	0.59	25	8
2659	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.902	234	4348180	0.78	26	9
2667	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.549	244	3693590	0.80	27	9
2694	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.408	244	5931570	0.80	28	9
2941	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.022	239	4504960	0.97	29	10
3172	OCTA-CDD	458/460 (87/100)	458+460	1.880	468	6174180	0.89	30	11

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 3/18/88 DATA ENTRY REVIEWED:____________DATE:________

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/22/88 REVIEWED:____________DATE:________

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/22/88 REVIEWED:____________DATE:________

10C18XQ7

PAGE 1 : TOTAL ANALYSIS

STANDARD SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910C18XQ7
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1692	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	92.1	1084380	0.75	1	
2692	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	192	2514200	0.78	2	
1629	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.958	47.1	1085800	0.77	3	1
2163	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.620	96.0	1831190	0.64	4	1
2575	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.420	194	3608250	0.79	5	2
2856	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.072	190	2667930	0.90	6	2
1718	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.376	49.0	794096	0.88	7	1
2305	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.881	97.0	1005840	0.59	8	1
2665	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.915	192	2300120	0.78	9	2
2940	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.654	192	1645240	0.93	10	2
3171	13C-OCDD	470/472 (87/100)	472	0.781	480	4909110	0.89	11	2
1630	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.605	96.6	5801520	0.79		3
2261	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.320	96.2	4256310	0.65		4
2642	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.214	244	10045390	0.81		5
2857	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.276	239	7638450	0.95		6
3180	OCTA-CDF	442/444 (87/100)	442+444	2.025	472	9775800	0.91		11
1719	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.388	95.3	3687820	0.76		7
2306	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.859	97.0	2875830	0.63		8
2693	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.666	244	7792530	0.80		9
2941	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.094	239	6336410	0.97		10
3172	OCTA-CDD	458/460 (87/100)	458+460	1.900	468	9096050	0.90		11

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 3/18/88 DATA ENTRY REVIEWED:__________ DATE:________

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/22/88 REVIEWED:__________ DATE:________

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/22/88 REVIEWED:__________ DATE:________

10018XQ7

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

STANDARD SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF STANDARDS

RESPONSE FACTOR (RF) = (AREA(S)/AREA(IS))*(CONC.(IS)/CONC.(S))

PROJECT NO: 8910L02-14
GC/MS DATA FILE: 8910C18XQ7
SAMPLE ID: 980-75 DF100-500

RECOVERY INTERNAL STANDARDS (C13)

TCDD	92.1 pg/ul
HxCDD	192 pg/ul

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	47.1 PG/UL
13C-1,2,3,7,8-PeCDF	96.0 PG/UL
13C-1,2,3,4,7,8-HxCDF	194 PG/UL
13C-1,2,3,4,6,7,8-HpCDF	190 PG/UL

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	49.0 PG/UL
13C-1,2,3,7,8-PeCDD	97.0 PG/UL
13C-1,2,3,6,7,8-HxCDD	192 PG/UL
13C-1,2,3,4,6,7,8-HpCDD	192 PG/UL
13C-OCDD	480 PG/UL

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR	CONC.ST (PG/UL)	TOTAL AREA	ACTUAL ION RATIO	ANALYTE #	QUANTITATED AGAINST #
1630	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.605	96.6	5801520	0.79	12	3
2156	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.395	110	5026220	0.59	13	4
2164	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.898	96.0	3476500	0.71	14	4
2261	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.320	96.2	4256310	0.65	15	4
2576	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.390	236	10492590	0.80	16	5
2588	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.519	239	11195640	0.81	17	5
2596	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.499	252	7024820	0.81	18	5
2642	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.214	244	10045390	0.81	19	5
2708	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	1.918	236	8420980	0.83	20	5
2857	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.276	239	7638450	0.95	21	6
2969	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.020	243	6891830	0.96	22	6
3180	OCTA-CDF	442/444 (87/100)	442+444	2.025	472	9775800	0.91	23	11
1719	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.388	95.3	3687820	0.76	24	7
2306	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.859	97.0	2875830	0.63	25	8
2658	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	2.127	234	5961620	0.79	26	9
2667	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.485	244	4342170	0.80	27	9
2693	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.666	244	7792530	0.80	28	9
2941	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.094	239	6336410	0.97	29	10
3172	OCTA-CDD	458/460 (87/100)	458+460	1.900	468	9096050	0.90	30	11

GC/MS ANALYST: D. MILLS ANALYSIS DATE: 3/18/88 DATA ENTRY REVIEWED:__________ DATE:________

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/22/88 REVIEWED:__________ DATE:________

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/22/88 REVIEWED:__________ DATE:________

L.5 EPA Audit Sample Results

TABLE L-9. EPA AUDIT SAMPLES PCDD/PCDF RESULTS (ng/sample)

Isomer	F-176[a]	F-145	F-130
2,3,7,8-TCDD	0.008	0.849	0.547
Other TCDD	0.008	8.71	16.4
1,2,3,7,8-PeCDD	0.010	1.85	3.36
Other PeCDD	0.010	15.3	27.4
1,2,3,4,7,8-HxCDD	0.023	3.97	4.57
1,2,3,6,7,8-HxCDD	0.031	3.54	6.45
1,2,3,7,8,9-HxCDD	0.015	4.88	8.46
Other HxCDD	0.009	16.5	28.0
1,2,3,4,6,7,8-HpCDD	0.012	13.2	21.3
Other HpCDD	0.012	11.3	19.3
Octa-CDD	0.023	22.4	33.6
2,3,7,8-TCDF	0.004	4.31	6.28
Other TCDF	0.004	20.8	34.8
1,2,3,4,8-PeCDF	0.009	0.789	1.30
1,2,3,7,8-PeCDF	0.011	1.96	3.26
2,3,4,7,8-PeCDF	0.009	2.24	3.91
Other PeCDF	0.009	25.0	39.6
1,2,3,4,7,8-HxCDF	0.005	5.83	11.0
1,2,3,6,7,8-HxCDF	0.005	2.39	4.48
1,2,3,4,7,9-HxCDF	0.007	0.212	0.446
2,3,4,6,7,8-HxCDF	0.007	2.34	4.6
1,2,3,7,8,9-HxCDF	0.008	0.123	0.281
Other HxCDF	0.005	14.5	25.1
1,2,3,4,6,7,8-HpCDF	0.008	16.5	27.8
1,2,3,4,7,8,9-HpCDF	0.016	1.17	1.50
Other HpCDF	0.009	3.83	5.10
Octa-CDF	0.022	10.0	5.91

[a] Analyte not detected; value denotes detection limit.

F176EPAX

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X7
SAMPLE ID: F-176 (EPA AUDIT)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 2.35 ng
13C-1,2,3,7,8,9-HxCDD 4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF 1.20 NG
13C-1,2,3,7,8-PeCDF 2.45 NG
13C-1,2,3,4,7,8-HxCDF 4.95 NG
13C-1,2,3,4,6,7,8-HpCDF 4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD 1.25 NG
13C-1,2,3,7,8-PeCDD 2.48 NG
13C-1,2,3,6,7,8-HxCDD 4.90 NG
13C-1,2,3,4,6,7,8-HpCDD 4.90 NG
13C-OCDD 12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1854	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1419130	NA	2.35	NA
2783	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2142650	NA	4.90	NA
1783	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	668960	0.573		47.7
2292	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1174550	1.279		52.2
2672	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	2108280	3.257		65.8
2942	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1381060	3.123		64.4
1882	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	458704	0.561		44.9
2418	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	579885	1.235		49.8
2756	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1246230	3.030		61.8
3024	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	849904	3.117		63.6
3268	13C-OCDD	470/472 (87/100)	472	0.605	2128410	8.051		65.5
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	5789	NDK	0.00400	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	9897	NDK	0.00908	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	4872	NDK	0.00511	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	6435	NDK	0.00948	
NA	OCTA-CDF	442/444 (87/100)	442+444	2.192	8318	NDK	0.0219	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	6872	NDK	0.00791	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	6677	NDK	0.00980	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	5460	NDK	0.00923	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	6382	NDK	0.0121	
NA	OCTA-CDD	458/460 (87/100)	458+460	2.044	8060	NDK	0.0229	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: DATE: 3/18/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/9/88 REVIEWED: DATE: 3/18/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/9/88 REVIEWED:__________ DATE:________

F176EPAX

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X7
SAMPLE ID: F-176 (EPA AUDIT)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD 2.35 ng
13C-1,2,3,7,8,9-HxCDD 4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF 1.20 NG
13C-1,2,3,7,8-PeCDF 2.45 NG
13C-1,2,3,4,7,8-HxCDF 4.95 NG
13C-1,2,3,4,6,7,8-HpCDF 4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD 1.25 NG
13C-1,2,3,7,8-PeCDD 2.40 NG
13C-1,2,3,6,7,8-HxCDD 4.90 NG
13C-1,2,3,4,6,7,8-HpCDD 4.90 NG
13C-OCDD 12.3 NG

PREDICTD SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1785	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.534	5789	NOK	0.00400	
2206	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	10439	NOK	0.00922	
2294	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	10439	NOK	0.0110	
2378	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	9897	NOK	0.00909	
2674	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	4872	NOK	0.00492	
2684	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	4872	NOK	0.00451	
2694	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	4872	NOK	0.00749	
2737	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	7038	NOK	0.00738	
2801	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	6752	NOK	0.00775	
2944	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	5237	NOK	0.00772	
3057	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	9464	NOK	0.0159	
3275	OCTA-CDF	442/444 (87/100)	442+444	2.192	8318	NOK	0.0219	
1884	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	6072	NOK	0.00791	
2420	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	6677	NOK	0.00980	
2748	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	10715	NOK	0.0228	
2758	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	10715	NOK	0.0307	
2785	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	9009	NOK	0.0152	
3026	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	6382	NOK	0.0121	
3270	OCTA-CDD	458/460 (87/100)	458+460	2.044	8060	NOK	0.0228	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: DATE: 3/18/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/9/88 REVIEWED: DATE: 3/19/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/9/88 REVIEWED:________ DATE:________

F145EPAX

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X0
SAMPLE ID: F-145 (EPA AUDIT)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.40 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1855	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1345660	NA	2.35	NA
2703	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	2203160	NA	4.90	NA
1704	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	715400	0.646		53.9
2291	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1313420	1.508		61.5
2671	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.400	2200380	3.190		64.4
2942	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	1357950	2.881		59.4
1803	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	530704	0.684		54.8
2918	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.770	659676	1.402		59.7
2756	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1203190	2.928		59.8
3023	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	870760	2.997		61.2
3267	13C-OCDD	470/472 (87/100)	472	0.605	2207510	7.836		63.7
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	38866605		25.1	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	36513855		30.0	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	25235044		25.4	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	14315040		21.5	
3277	OCTA-CDF	442/444 (87/100)	442+444	2.192	3945708		10.0	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	9609511		9.56	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	13258451		17.1	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	17619368		20.9	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	13235000		24.5	
3268	OCTA-CDD	458/460 (87/100)	458+460	2.044	9219130		22.4	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: Mike Molly DATE: 3/21/88

DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/9/88 REVIEWED: Mike Molly DATE: 3/21/88

DATA ENTRY: M. WHITACRE ENTRY DATE: 3/9/88 REVIEWED:__________ DATE:________

F145EPAX

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MMS TRAIN EXTRACTS

AMOUNT-IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30XA
SAMPLE ID: F-145 (EPA AUDIT)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.40 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTD SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1786	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.534	6671300		4.31	
2205	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	999536		0.709	
2293	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.980	2091032		1.96	
2377	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	2729460		2.24	
2673	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	6036280		5.83	
2683	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	2696850		2.39	
2693	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	143600		0.212	
2736	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	2320250		2.34	
2800	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+376	2.045	112092		0.123	
2944	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.303	11021948		16.5	
3057	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	688628		1.17	
3274	OCTA-CDF	442/444 (87/100)	442+444	2.192	3930190		10.01	
1805	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	853552		0.849	
2420	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	1432028		1.85	
2740	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	1919300		3.97	
2750	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	1270760		3.54	
2785	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	2972200		4.08	
3025	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	7130770		13.2	
3269	OCTA-CDD	458/460 (87/100)	458+460	2.044	8219130		22.4	

GC/MS ANALYST: R. ROBSON   ANALYSIS DATE: 1/30/88   DATA ENTRY REVIEWED: ______ DATE: 3/21/88
DATA ANALYST: M. WHITACRE   ANALYSIS DATE: 3/9/88   REVIEWED: ______ DATE: 3/21/88
DATA ENTRY: M. WHITACRE   ENTRY DATE: 3/9/88   REVIEWED: ______ DATE: ______

F130EPAX

PAGE 1 : TOTAL ANALYSIS

SAMPLE SPREADSHEET FOR THE QUANTITATION OF TOTAL TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X6
SAMPLE ID: F-130 (EPA AUDIT)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.90 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

SURROGATE RECOVERY = (AREA(S)/AREA(IS))*(AMT(IS)/RF)*SPLIT RATIO

SURROGATE RECOVERY % = (SURROGATE RECOVERY/AMOUNT OF SURROGATE ADDED)*100%

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1852	13C-1,2,3,4-TCDD	332/334 (76/100)	332	1.000	1798810	NA	2.35	NA
2781	13C-1,2,3,7,8,9-HxCDD	402/404 (100/82)	402	1.000	3351430	NA	4.90	NA
1780	13C-2,3,7,8-TCDF	316/318 (76/100)	316	1.934	987400	0.667		55.6
2289	13C-1,2,3,7,8-PeCDF	350/352 (61/100)	352	1.521	1809310	1.554		63.4
2669	13C-1,2,3,4,7,8-HxCDF	386/388 (100/82)	386	1.480	3006140	2.969		60.0
2940	13C-1,2,3,4,6,7,8-HpCDF	420/422 (100/98)	420	1.011	2040200	2.949		60.8
1879	13C-2,3,7,8-TCDD	332/334 (76/100)	332	1.354	660890	0.638		51.0
2416	13C-1,2,3,7,8-PeCDD	366/368 (61/100)	368	0.778	860724	1.460		58.9
2753	13C-1,2,3,6,7,8-HxCDD	402/404 (100/82)	402	0.940	1815310	2.822		57.6
3021	13C-1,2,3,4,6,7,8-HpCDD	436/438 (100/99)	436	0.624	1331830	3.123		63.7
3265	13C-OCDD	470/472 (87/100)	472	0.605	3450710	8.345		67.8
NA	TOTAL-TETRA-CDF	304/306 (76/100)	304+306	2.594	87608195		41.05	
NA	TOTAL-PENTA-CDF	338/340 (61/100)	338+340	2.273	80620409		48.04	
NA	TOTAL-HEXA-CDF	374/376 (100/82)	374+376	2.238	62351457		45.9	
NA	TOTAL-HEPTA-CDF	408/410 (100/98)	408+410	2.383	34507726		34.4	
3275	OCTA-CDF	442/444 (87/100)	442+444	2.192	3635780		5.91	
NA	TOTAL-TETRA-CDD	320/322 (76/100)	320+322	2.367	21180259		16.9	
NA	TOTAL-PENTA-CDD	354/356 (61/100)	354+356	2.914	31449200		30.8	
NA	TOTAL-HEXA-CDD	390/392 (100/82)	390+392	2.325	40903392		47.5	
NA	TOTAL-HEPTA-CDD	424/426 (100/99)	424+426	3.036	33499620		40.6	
3266	OCTA-CDD	458/460 (87/100)	458+460	2.044	19290660		33.6	

GC/MS ANALYST: R. ROBSON ANALYSIS DATE: 1/30/88 DATA ENTRY REVIEWED: Mike Mills DATE: 3/21/88
DATA ANALYST: M. WHITACRE ANALYSIS DATE: 3/9/88 REVIEWED: [illegible] DATE: 3/21/88
DATA ENTRY: M. WHITACRE ENTRY DATE: 3/9/88 REVIEWED: ________ DATE: ________

F130EPAK

PAGE 2: NATIVE 2,3,7,8 SUBSTITUTED ANALYTES

SAMPLE SPREADSHEET FOR THE QUANTITATION OF SPECIFIC TETRA-OCTA CDD/CDF MM5 TRAIN EXTRACTS

AMOUNT IN SAMPLE (NG) = (AREA(S)/AREA(IS)*AMT(IS)/RF)

PROJECT NO: 8910L02
GC/MS DATA FILE: 8910A30X6
SAMPLE ID: F-130 (EPA AUDIT)

RECOVERY INTERNAL STANDARDS

13C-1,2,3,4-TCDD	2.35 ng
13C-1,2,3,7,8,9-HxCDD	4.90 ng

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDF	1.20 NG
13C-1,2,3,7,8-PeCDF	2.45 NG
13C-1,2,3,4,7,8-HxCDF	4.95 NG
13C-1,2,3,4,6,7,8-HpCDF	4.85 NG

SPLIT RATIO = 1

METHOD INTERNAL STANDARDS

13C-2,3,7,8-TCDD	1.25 NG
13C-1,2,3,7,8-PeCDD	2.48 NG
13C-1,2,3,6,7,8-HxCDD	4.98 NG
13C-1,2,3,4,6,7,8-HpCDD	4.90 NG
13C-OCDD	12.3 NG

PREDICTO SCAN NUMBER	ANALYTE	CHARACTERISTIC IONS (THEORETICAL RATIO)	ION USED	RESPONSE FACTOR (1/28/88)	TOTAL AREA	SURROGATE RECOVERY (NG)	AMOUNT IN SAMPLE (NG)	SURROGATE RECOVERY (%)
1782	2,3,7,8-TETRA-CDF	304/306 (76/100)	304+306	2.594	13401970		6.28	
2283	1,2,3,4,8-PENTA-CDF	338/340 (61/100)	338+340	2.362	2273270		1.30	
2291	1,2,3,7,8-PENTA-CDF	338/340 (61/100)	338+340	1.988	4790170		3.26	
2375	2,3,4,7,8-PENTA-CDF	338/340 (61/100)	338+340	2.272	6561050		3.91	
2671	1,2,3,4,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.327	15495670		10.96	
2681	1,2,3,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.537	6904958		4.18	
2691	1,2,3,4,7,9-HEXA-CDF	374/376 (100/82)	374+376	1.527	414016		0.416	
2734	2,3,4,6,7,8-HEXA-CDF	374/376 (100/82)	374+376	2.238	6249710		4.60	
2798	1,2,3,7,8,9-HEXA-CDF	374/376 (100/82)	374+326	2.045	348965		0.281	
2942	1,2,3,4,6,7,8-HEPTA-CDF	408/410 (100/98)	408+410	2.383	27092400		27.8	
3055	1,2,3,4,7,8,9-HEPTA-CDF	408/410 (100/98)	408+410	2.095	1325776		1.50	
3272	OCTA-CDF	442/444 (87/100)	442+444	2.192	3635780		5.91	
1881	2,3,7,8-TCDD	320/322 (76/100)	320+322	2.367	685089		0.547	
2418	1,2,3,7,8-PENTA-CDD	354/356 (61/100)	354+356	2.914	3428910		3.36	
2745	1,2,3,4,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.847	3133750		4.58	
2755	1,2,3,6,7,8-HEXA-CDD	390/392 (100/82)	390+392	1.372	3278740		6.45	
2782	1,2,3,7,8,9-HEXA-CDD	390/392 (100/82)	390+392	2.325	7206640		8.46	
3023	1,2,3,4,6,7,8-HEPTA-CDD	424/426 (100/99)	424+426	3.036	17617270		21.3	
3267	OCTA-CDD	458/460 (87/100)	458+460	2.044	19290560		33.6	

GC/MS ANALYST:	R. ROBSON	ANALYSIS DATE:	1/30/88	DATA ENTRY REVIEWED: DATE: 3/12/1988	
DATA ANALYST:	M. WHITACRE	ANALYSIS DATE:	3/9/88	REVIEWED: DATE: 3/12/1988	
DATA ENTRY:	M. WHITACRE	ENTRY DATE:	3/9/88	REVIEWED:______ DATE:______	

MRI

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AUDIT RESULTS CALCULATION AND INTERPRETATION

Determination of True Value for Audit Samples

The 90% confidence interval was calculated for each of the 25 CDD/CDF isomers or isomer groups using the values reported by EPA/EMSL, NY State and Wright St. If an isomer was not detected, three times the reported detection limit was used in the confidence interval calculations. The average values for the specific CDD and CDF from each of the different audit samples concentrations analyzed were used to determine the confidence intervals for most isomers. However, in cases where the reported values for an isomer showed an actual interval signficantly larger than the average interval, the actual confidence interval was used. The interval based on the average of the values was used because the individual 90% confidence intervals for the isomers varied greatly due to the small number of laboratories analyzing the audit samples.

Audit Report

The audit report is a computer generated report using a validated program. If the audit sample number and the individual analytical values are properly entered, the audit report results are correct.

The audit results are calculated as follows:

Item 1 - For each of the eleven CDD, the audit value was compared to the appropoiate calculated confidence interval. The number of values outside the 90% confidence interval was counted and is presented.

Item 2 - An additional range, 50% above and 50% below the 90% confidence interval was calculated. The bottom limit of the range is the value 50% of the lower value of the 90% confidence interval. The upper limit of the range is the value 150% of the upper value of the 90% confidence interval. All values outside the range in Item 2 would have also been counted in Item 1. The number of values outside the 90% confidence interval and within 50% of the confidence interval can be determined by subtracting the value reported in Item 1 from the value reported in Item 2.

Item 3 - The calculations for Item 3 are the same as for Item 1 using the CDF isomers.

Item 4 - The calculations for Item 4 are the same as for Item 2 using the CDF isomers.

Item 5 - In an effort to provide an estimate of the impact that the audit analtyical results would have in relation to the toxicity of the CDD/CDF isomers, the percent errors for the analytical values outside the 90% confidence interval were multiplied by the aproproiate 2,3,7,8-TCDD toxic equivalency factor, and the average weighted absolute percent error calculated. The bias was then calculated using the individual weighted percent errors. If the bias is positive (+), then the auditee's analytical values were higher than the true values. If the the bias is negative (-), then the auditee's weighted values were lower than the true values. The average percent error and bias cannot be used for direct correction of the emission data because (1) the number of audit samples analyzed by the auditee is usually too small and (2) the ratio(s) of CDD and CDF isomers for the audit sample(s) may be different from those for the emission samples.

U.S. EPA QUALITY ASSURANCE DIVISION DIOXIN/FURAN AUDIT FORM

AUDITEE Midwest Research Institute ADDRESS Kansas City, Missouri
AUDIT SAMPLE NO. 130 DATE OF AUDIT 4/14/88

Compound	Auditee Result (ng/sample)	Compound	Auditee Result (ng/sample)
2378-TCDD	0.547	2378-TCDF	6.28
Other TCDD	16.4	Other TCDF	34.8
12378-PCDD	3.36	12378-PCDF	3.26
Other PCDD	27.4	23478-PCDF	3.91
123478-HxCDD	4.58	Other PCDF	40.9
123678-HxCDD	6.45	123478-HxCDF	11.0
123789-HxCDD	8.46	123678-HxCDF	4.48
Other HxCDD	28.0	123789-HxCDF	0.281
1234678-HpCDD	21.3	234678-HxCDF	4.6
Other HpCDD	19.3	Other HxCDF	25.5
OCDD	33.6	1234678-HpCDF	27.8
		1234789-HpCDF	1.50
		Other HpCDF	5.10
		OCDF	5.91

The results of the above performance audit sample are as follows:

RESULTS OF THE POLYCHLORINATED DIBENZODIOXINS (CDD)

1) 0 of the 11 different CDD are not within the 90% confidence intervals.
2) 0 of the 11 different CDD are not within 50% of the 90% confidence intervals.

RESULTS OF THE POLYCHLORINATED DIBENZOFURANS (CDF)

3) 2 of the 14 different CDF are not within the 90% confidence intervals.
4) 2 of the 14 different CDF are not within 50% of the 90% confidence intervals.

RESULTS BASED ON A 2,3,7,8-TCDD TOXIC EQUIVALENCY FACTORS

5) Based on the 2,3,7,8-TCDD toxic equivalency factors, the average percent error outside the 90% confidence limits was 6.3% with an average bias of +5.5%.

Note: For those CDD and CDF reported as not detected by the Auditee, three times the reported detection limit (in parantheses) was used for the calculations. The identical procedure was used for calculating the confidence intervals.

U.S. EPA QUALITY ASSURANCE DIVISION DIOXIN/FURAN AUDIT FORM

AUDITEE Midwest Research Institute ADDRESS Kansas City, Missouri
AUDIT SAMPLE NO. 145 DATE OF AUDIT 4/14/88

Compound	Auditee Result (ng/sample)	Compound	Auditee Result (ng/sample)
2378-TCDD	0.849	2378-TCDF	4.31
Other TCDD	8.71	Other TCDF	20.8
12378-PCDD	1.85	12378-PCDF	1.96
Other PCDD	15.3	23478-PCDF	2.24
123478-HxCDD	3.97	Other PCDF	25.0
123678-HxCDD	3.54	123478-HxCDF	5.83
123789-HxCDD	4.88	123678-HxCDF	2.39
Other HxCDD	16.5	123789-HxCDF	0.123
1234678-HpCDD	13.2	234678-HxCDF	2.34
Other HpCDD	11.3	Other HxCDF	14.5
OCDD	22.4	1234678-HpCDF	16.5
		1234789-HpCDF	1.17
		Other HpCDF	3.83
		OCDF	10.0

The results of the above performance audit sample are as follows:

RESULTS OF THE POLYCHLORINATED DIBENZODIOXINS (CDD)

1) 0 of the 11 different CDD are not within the 90% confidence intervals.
2) 0 of the 11 different CDD are not within 50% of the 90% confidence intervals.

RESULTS OF THE POLYCHLORINATED DIBENZOFURANS (CDF)

3) 2 of the 14 different CDF are not within the 90% confidence intervals.
4) 2 of the 14 different CDF are not within 50% of the 90% confidence intervals.

RESULTS BASED ON A 2,3,7,8-TCDD TOXIC EQUIVALENCY FACTORS

5) Based on the 2,3,7,8-TCDD toxic equivalency factors, the average percent error outside the 90% confidence limits was 5.5% with an average bias of +5.2%.

Note: For those CDD and CDF reported as not detected by the Auditee, three times the reported detection limit (in parantheses) was used for the calculations. The identical procedure was used for calculating the confidence intervals.

U.S. EPA QUALITY ASSURANCE DIVISION DIOXIN/FURAN AUDIT FORM

AUDITEE Midwest Research Institute ADDRESS Kansas City, Missouri
AUDIT SAMPLE NO. 176 DATE OF AUDIT 4/14/88

Compound	Auditee Result (ng/sample)	Compound	Auditee Result (ng/sample)
2378-TCDD	(0.024)	2378-TCDF	(0.012)
Other TCDD	(0.024)	Other TCDF	(0.012)
12378-PCDD	(0.030)	12378-PCDF	(0.033)
Other PCDD	(0.030)	23478-PCDF	(0.027)
123478-HxCDD	(0.069)	Other PCDF	(0.027)
123678-HxCDD	(0.093)	123478-HxCDF	(0.015)
123789-HxCDD	(0.045)	123678-HxCDF	(0.015)
Other HxCDD	(0.027)	123789-HxCDF	(0.024)
1234678-HpCDD	(0.036)	234678-HxCDF	(0.021)
Other HpCDD	(0.036)	Other HxCDF	(0.015)
OCDD	(0.069)	1234678-HpCDF	(0.024)
		1234789-HpCDF	(0.048)
		Other HpCDF	(0.027)
		OCDF	(0.066)

The results of the above performance audit sample are as follows:

RESULTS OF THE POLYCHLORINATED DIBENZODIOXINS (CDD)

1) 0 of the 11 different CDD are not within the 90% confidence intervals.
2) 0 of the 11 different CDD are not within 50% of the 90% confidence intervals.

RESULTS OF THE POLYCHLORINATED DIBENZOFURANS (CDF)

3) 0 of the 14 different CDF are not within the 90% confidence intervals.
4) 0 of the 14 different CDF are not within 50% of the 90% confidence intervals.

RESULTS BASED ON A 2,3,7,8-TCDD TOXIC EQUIVALENCY FACTORS

5) Based on the 2,3,7,8-TCDD toxic equivalency factors, the average percent error outside the 90% confidence limits was 0.0% with an average bias of 0.0%.

Note: For those CDD and CDF reported as not detected by the Auditee, three times the reported detection limit (in parantheses) was used for the calculations. The identical procedure was used for calculating the confidence intervals.

L.6 Metals Spikes and NBS Standard Recoveries

RESULTS OF EPA AND INTERNAL METALS AUDIT SAMPLE ANALYSIS

Audit no.	As (µg)	Accuracy (%)	Cd (µg/mL)	Accuracy (%)	Cr (µg)	Accuracy (%)	Pb (µg)	Accuracy (%)
101	2270	91	NA	NA	253	101	999	100
102	1120	97	NA	NA	169	135	585	117
103	NA	NA	494	103	NA	NA	NA	NA
104	NA	NA	161	101	NA	NA	NA	NA
Reanalysis 3/23/88								
102	NA	NA	NA	NA	167	134	NA	NA
WP 283 1	NA	NA	NA	NA	1.34	107	NA	NA
Reanalysis 3/28/88								
102	NA	NA	NA	NA	155	124	NA	NA
WP 283 1	NA	NA	NA	NA	1.28	102	NA	NA

NA = Not analyzed or not applicable.

The certified value of the EPA WP 283 conc. 1 standard is 1.25 µg/mL. The audit sample true values are:

101	2500 µg As, 250 µg Cr, 1000 µg Pb
102	1150 µg As, 125 µg Cr, 500 µg Pb
103	480 µg/mL Cd
104	160 µg/mL Cd

Table 2. Raw Data for Audit Sample Analysis.

Project: 8910L0213
Lotus File: 30488
Jarrell-Ash Data File: 30488, 32388, 32888
Analyst: E. McClendon
Analysis Date: 3-4-88, 3-23-88, 3-28-88
Data Analyst: E. McClendon
Date: 3-4-88
Analyte: (see below)

As, Cd & Pb
Verified by: NT 5-4-88

Cr Verified by:
NT 5-4-88

ASF Bar Code No.	Element As	Element Cd	Element Cr	Element Pb
04381	4.6492	NA	0.51042	2.0075
	4.5461	NA	0.49966	1.9993
	4.4274	NA	0.50799	1.9893
04382	2.3004	NA	0.33428	1.1747
	2.2314	NA	0.34396	1.1853
	2.1783	NA	0.33825	1.1515
04383	NA	0.97122	NA	NA
	NA	1.0073	NA	NA
	NA	0.9828	NA	NA
04384	NA	0.32462	NA	NA
	NA	0.32048	NA	NA
	NA	0.32067	NA	NA
Reanalysis 3-23-88				
04382	NA	NA	0.66891	NA
WP 283 #1	NA	NA	0.26849	NA
Reanalysis 3-28-88				
04382	NA	NA	0.62143	NA
WP 283 #1	NA	NA	0.25542	NA

Raw data is found in Appendix H-2.

Table 7a. Spike and Percent Recovery Data - Ashes and Lime Slurries.

Lotus File: 0412
Data Analyst: E. McClendon
Date: 6-14-88
Analyte: (see below)

Verif E. McClendon 6-17-88

MRI Sample ID	Units	Arsenic Final Results	Cadmium Final Results	Chromium Final Results	Mercury Final Results	Lead Final Results
Bag. Ash 09171	ug/g	47.6	129	152	80.2	2767
09172	ug/g	134	227	185	244	6011
Spike Level		98.6	98.6	98.6	197	3254
% Recovery		88.0	99.4	33.4	82.9	99.7
Lime 09174	ug/g	4.95	-0.229	-0.955	-0.225	-5.85
09175	ug/g	3.55	-0.224	-0.931 ✓	-0.223	-5.70
09176	ug/g	16.1	8.98	5.978	19.0	19.8
Spike Level		9.48	9.48	9.48	19.0	28.4
% Recovery		125	94.8	63.0	100	69.5
NBS STD 09181	ug/g	127	-2.57	223	-0.264	124
Cert. Value		145	1.00	196	0.16	72.4
% Recovery		87.5	NA	114	NA	172
Low Ref Spike	ug Total	5.83	5.07	4.61	9.60	17.0
Spike Level		4.90	4.90	4.90	9.80	14.7
% Recovery		119	104	94.0	98.0	116
High Ref Spike	ug Total	59.1	52.4	54.5	97.3	1836
Spike Level		50.0	50.0	50.0	100	1650
% Recovery		118	105	109	97.3	111

NA = Not Applicable or Not Analyzed
A negative Value indicates that the sample was less than the detection limit.

Note: Raw data is found in Appendix H.2

L.7 Metals Calibration Data

METALS INSTRUMENT CHECK STANDARD DATA AND PERCENT DRIFT CALCULATIONS

ICAP run	Element Cd	% drift	Element Cr	% drift	Element Hg	% drift	Element Pb	% drift
3/23/88								
Initial ICS	5.1069		5.0202		5.102		5.1591	
ICS1	5.106	0.02	4.9996	0.41	5.1285	0.52	5.1897	0.59
ICS2	5.1484	0.81	5.0565	0.72	5.3784	5.42	5.3095	2.92
ICS3	5.1555	0.95	5.0662	0.92	5.3894	5.63	5.3963	4.60
3/23/88								
Initial ICS	5.1287		5.0635		5.1273		5.0773	
ICS1	5.2551	2.46	5.2280	3.25	5.3269	3.89	5.2546	3.49
ICS2	5.3029	3.340	5.2559	3.80	5.4021	5.36	5.2510	3.42
ICS3	5.3222	3.77	5.2256	3.20	5.4371	6.04	5.2624	3.65
4/12/88								
Initial ICS	5.0635		50.424		5.0489		5.0269	
ICS1	5.0869	0.46	5.0437	0.03	5.0892	0.80	5.0338	0.14
ICS2	5.1201	1.12	5.1225	1.59	5.0146	0.68	5.0811	1.08
6/7/88								
Initial ICS	5.0223		5.0368		NA		5.0824	
ICS1	4.9558	1.32	4.9838	1.05	NA	NA	5.2699	3.69
ICS2	5.0530	0.61	5.0637	0.53	NA	NA	5.4326	6.89

GFAA run	Absorbance	% drift
3/31/88 Pb		
Initial ICS	0.119	
ICS1	0.119	0.00
ICS2	0.120	0.84
ICS3	0.121	1.68
ICS4	0.123	3.36
4/1/88 As		
Initial ICS	0.197	
ICS1	0.208	5.58
ICS2	0.215	9.14
ICS3	0.205	4.06
ICS4	0.211	7.11
ICS5	0.212	7.61
4/4/88 As		
Initial ICS	0.211	
ICS1	0.214	1.42
ICS2	0.231	9.48
ICS3	0.233	10.43
ICS4	0.235	11.37
ICS5	0.225	6.64
ICS6	0.234	10.90

Hg CVAAS run	Absorbance	% drift
1/7/88		
Initial ICS	0.144	
ICS1	0.142	1.39
ICS2	0.141	2.08
ICS3	0.144	0.00
ICS4	0.144	0.00
4/9/88		
Iniital ICS	0.244	
ICS1	0.262	7.38
ICS2	0.269	10.25
4/13/88		
Iniital ICS	0.236	
ICS1	0.236	0.00
ICS2	0.239	1.27
4/14/88		
Initial ICS	0.223	
ICS1	0.226	1.35
ICS2	0.228	2.24

GFAA run	Absorbance	% drift	Hg CVAAS run	Absorbance	% drift
4/8/88 Pb			6/7/88		
Initial ICS	0.147		Initial ICS	0.256	
ICS1	0.135	8.16	ICS1	0.256	0.00
ICS2	0.125	14.97	ICS2	0.271	5.86
			ICS3	0.273	6.64
6/6/88 As					
Initial ICS	0.199				
ICS1	0.204	2.51			
ICS2	0.215	8.04			
ICS3	0.227	14.07			
6/6/88 Pb					
Initial ICS	0.229				
ICS1	0.231	0.87			
ICS2	0.232	1.31			

Note: These analyses were conducted on a Jarrell-Ash Model 1155A ICP-AES, a Perkin-Elmer Model 5000 Zeeman atomic absorption spectrometer and a Perkin-Elmer 3030B atomic absorption spectrometer. The atomic abosrption units were equipped with a hollow cathode lamp for Pb or electrodeless discharge lamps for Hg or As.

Table 5. ICS and Percent Drift Calculations.

Lotus File: 0412
Data Analyst: E. McClendon
Date: 5-6-88
Analyte: (see below)

Verified by EMcClendon 5-6-88

ICAP Run	Element Cd	% Drift	Element Cr	% Drift	Element Hg	% Drift
3-23-88						
Initial ICS	5.1069		5.0202		5.1020	
ICS1	5.1060	0.02	4.9996	0.41	5.1285	0.52
ICS2	5.1484	0.81	5.0565	0.72	5.3784	5.42
ICS3	5.1555	0.95	5.0662	0.92	5.3894	5.63
3-28-88						
Initial ICS	5.1287		5.0635		5.1273	
ICS1	5.2551	2.46	5.2280	3.25	5.3269	3.89
ICS2	5.3029	3.40	5.2559	3.80	5.4021	5.36
ICS3	5.3222	3.77	5.2256	3.20	5.4371	6.04
4-12-88						
Initial ICS	5.0635		5.0424		5.0489	
ICS1	5.0869	0.46	5.0437	0.03	5.0892	0.80
ICS2	5.1201	1.12	5.1225	1.59	5.0146	0.68

GFAA Run	Absorbance	% Drift
3-31-88 Pb		
Initial ICS	0.119	
ICS1	0.119	0.00
ICS2	0.120	0.84
ICS3	0.121	1.68
ICS4	0.123	3.36
4-1-88 As		
Initial ICS	0.197	
ICS1	0.208	5.58
ICS2	0.215	9.14
ICS3	0.205	4.06
ICS4	0.211	7.11
ICS5	0.212	7.61
4-4-88 As		
Initial ICS	0.211	
ICS1	0.214	1.42
ICS2	0.231	9.48
ICS3	0.233	10.43
ICS4	0.235	11.37
ICS5	0.225	6.64
ICS6	0.234	10.90
4-8-88 Pb		
Initial ICS	0.147	
ICS1	0.135	8.16
ICS2	0.125	14.97

CVAAS Run	Absorbance	% Drift
1-7-88 Hg		
Initial ICS	0.144	
ICS1	0.142	1.39
ICS2	0.141	2.08
ICS3	0.144	0.00
ICS4	0.144	0.00
4-9-88 Hg		
Initial ICS	0.244	
ICS1	0.262	7.38
ICS2	0.269	10.25
4-13-88 Hg		
Initial ICS	0.236	
ICS1	0.236	0.00
ICS2	0.239	1.27
4-14-88 Hg		
Initial ICS	0.223	
ICS1	0.226	1.35
ICS2	0.228	2.24

Table 5a. ICAP ICS and Percent Drift Calculations for 6-7-88.

Lotus File: 0412
Data Analyst: E. McClendon
Date: 6-17-88
Analyte: (see below)

Verified E McClendon 6-17-88

	Element Cd	% Drift	Element Cr	% Drift	Element Pb	% Drift
6-7-88						
Initial ICS	5.0223		5.0368		5.0824	
ICS1	4.9558	1.32	4.9838	1.05	5.2699	3.69
ICS2	5.0530	0.61	5.0637	0.53	5.4326	6.89

Note: Raw Data is found in Appendix H-2.

L.8 Metals Duplicate Sample Analysis

DUPLICATE METALS ANALYSIS RESULTS

Sample	Units	Arsenic final results	Cadmium final results	Chromium final results	Mercury final results	Lead final results
Run 1						
Cyclone ash	µg/g	30.3	30.5	390	< 7.96	2,168
Dup	µg/g	34.1	30.8	377	< 22.6	2,028
% difference		12.0	1.00	3.44	NA	6.69
Run 1						
Lime slurry	µg/g	4.95	< 0.229	< 0.955	< 0.225	< 5.85
Dup	µg/g	3.55	< 0.224	< 0.931	< 0.223	< 5.70
% difference		33.1	NA	NA	NA	NA
Run 1						
Inlet acetone rinse	µg total	94.5	121	458	205	3,943
Dup	µg total	94.5	122	469	203	3,961
% difference		0.00	0.46	2.45	1.03	0.45
Run 1						
Outlet acetone rinse	µg total	< 2.58	< 0.750	4.29	< 3.16	15.4
Dup	µg total	< 2.58	< 0.750	3.69	< 3.19	15.9
% difference		NA	NA	15.0	NA	2.94
Run						
Inlet front half	µg total	799	1,770	3,824	726	44,417
Dup	µg total	751	1,716	3,897	681	44,472
% difference		6.29	3.12	1.89	6.29	0.12
Run 1						
Outlet front half	µg total	< 9.03	12.7	< 4.47	< 9.55	204
Dup	µg total	< 9.03	11.7	< 4.47	< 10.3	203
% difference		NA	8.37	NA	NA	0.57
Run 1						
Inlet back half	µg total	1.52	4.27	2.04	NA	14.7
Dup	µg total	NA	4.20	1.72	NA	14.8
% difference		NA	1.69	16.93	NA	0.47
Run 1						
Inlet permanganate	µg/g	NA	NA	NA	0.00121	NA
Dup	µg/g	NA	NA	NA	0.00134	NA
% difference		NA	NA	NA	10.13	NA
Run 1						
Outlet permanganate	µg/g	NA	NA	NA	0.000769	NA
Dup	µg/g	NA	NA	NA	0.000758	NA
% difference		NA	NA	NA	1.37	NA

NA = not applicable or not analyzed.

Table 6a. Duplicate and Percent Difference Results for Ashes and Lime Slurries.

Lotus File: 0412
Data Analyst: E. McClendon
Date: 6-14-88
- Analyte: (see below)

Verf E L McClendon 6-17-88

MRI Sample ID	Units	Arsenic Final Results	Cadmium Final Results	Chromium Final Results	Mercury Final Results	Lead Final Results
09169	ug/g	30.3	30.5	390	7.96	2168
09170	ug/g	34.1	30.8	377	22.6	2028
% Difference		11.99	1.00	3.44	NA	6.69
09174	ug/g	4.95	<0.229	<0.955	<0.225	<5.85
09175	ug/g	3.55	<0.224	<0.931	<0.223	<5.70
% Difference		33.13	NA	NA	NA	NA

Note: Raw data is found in Appendix H-2.

L.9 CEM Calibration Data

```
MR3IN
MERC RUN 3 INLET
12-11-1987
INLET
8910-L02-12
LCONE                    (Recorder Channel #)
           0        1        2        3        4
          O2      CO2       CO      THC      SO2
08:39           2.80     1.81     2.10     0.00     4.33
08:40           2.89     1.95     2.05     0.00     4.32
08:41           2.96     1.95     2.10     0.00     4.31
08:42           2.74     1.84     2.17     0.00     4.31
08:43           2.70     1.85     2.20     0.00     4.31
08:43 INIT. ZERO
 0   O2   2.70
 1  CO2   1.85
 2   CO   2.20
 4  SO2   4.31
09:09           3.20     2.02     2.27     1.56    94.16
09:10           3.27     1.93     2.20     1.58    94.24
09:11           3.36     1.83     2.33     1.57    94.32
09:11 INIT. SPAN
 4  SO2  94.32   413.00
09:32          51.42    81.07    50.22     1.41     9.93
09:33          51.45    81.06    50.14     1.39     9.86
09:34          51.45    81.00    50.09     1.37     9.79
09:34 INIT. SPAN
 0   O2  51.45    12.09
 1  CO2  81.00    12.00
 2   CO  50.09   338.00
09:38           3.20     2.62     4.71     1.42     9.52
09:39           2.67     2.50     3.86     1.47     9.49
09:39 INIT. ZERO
 4  SO2   9.49
10:26          18.33    81.20    48.21     3.02     8.93
10:27          18.48    81.29    48.53     3.05     8.92
10:27 INIT. ZERO
 3  THC   3.05
10:32          18.56    81.42    48.63    70.04     8.96
10:33          18.61    81.40    48.77    69.75     8.97
10:34          16.62    81.33    48.80    69.37     8.96
10:34 INIT. SPAN
 3  THC  69.37    10.20


10:35  18.66  81.33  48.90  70.03   8.93   <- 1ST Line = Chart divisions
10:35   3.96  12.09  288.6   10.3   -2.7      2nd Line = concentration (% or ppm)

10:36  16.65  81.39  48.80  68.48   8.93
10:36   3.96  12.10  287.8   10.1   -2.7

10:37  18.70  81.37  48.77  60.89   8.93
10:37   3.97  12.10  287.7    8.9   -2.7

10:38  18.72  81.29  48.91   5.17   8.92
10:38   3.97  12.08  288.7    0.3   -2.8

10:39  18.75  81.30  48.81   2.91   8.91
10:39   3.98  12.08  288.0   -0.0   -2.8

10:40  18.75  81.52  48.83   3.20   8.90
10:40   3.98  12.14  288.0    0.0   -2.9

10:41  18.79  81.43  48.75   3.21   8.88  <-- 12% CO2, 336 ppm CO, 4.01% O2
10:41   3.99  12.11  287.4    0.0   -2.9
```

```
10:47   3.31  82.55   5.18   3.41   8.85
10:47   0.15  12.41   16.0    0.1   -3.1

10:48   2.50  82.56   4.66   3.45   8.84
10:48  -0.05  12.42   13.3    0.1   -3.2

10:49   2.34  82.59   4.40   3.47   8.83 ←— 12.4% CO2
10:49  -0.09  12.43   11.9    0.1   -3.2


10:59  59.05   2.18   2.74   3.13   8.80
10:59  13.97   0.06    3.6    0.0   -3.4

11:00  59.11   2.07   2.54   3.14   8.79
11:00  13.99   0.05    2.4    0.0   -3.4

11:01  59.15   2.07   2.52   3.16   8.79
11:01  14.00   0.05    2.3    0.0   -3.4

11:02  59.15   2.06   2.61   3.13   8.79
11:02  14.00   0.05    2.8    0.0   -3.4 ——14.01% O2


11:22   2.15   1.81   2.35  65.76  87.09
11:22  -0.13   0.04    1.3    9.6  377.8

11:23   2.13   1.85   2.53  65.83  87.30
11:23  -0.14   0.05    2.4    9.7  378.8

11:24   2.13   1.89   2.42  65.88  87.46 ←— 9.5ppm C3H8
11:24  -0.14   0.05    1.7    9.7  379.6

11:25   2.16   1.92   2.38  65.90  87.62
11:25  -0.13   0.05    1.5    9.7  380.4

11:26   2.15   1.86   2.31  65.57  87.75
11:26  -0.13   0.05    1.1    9.6  381.0←— ~~409.~~ 412.7 ppm SO2


11:41   2.37   1.78  61.40   3.27  10.21
11:41  -0.08   0.04  434.8    0.0    3.5

11:42   2.38   1.83  61.35   3.29  10.13
11:42  -0.08   0.05  434.4    0.0    3.2

11:43   2.38   1.82  61.31   3.44  10.04
11:43  -0.08   0.04  434.0    0.1    2.7

11:44   2.31   1.95  61.38   3.40   9.97 ← 409.7 ppm CO
11:44  -0.10   0.05  434.6    0.1    2.4

11:51   2.04   1.84   2.81   3.14  27.03
11:51  -0.16   0.05    4.0    0.0   85.4

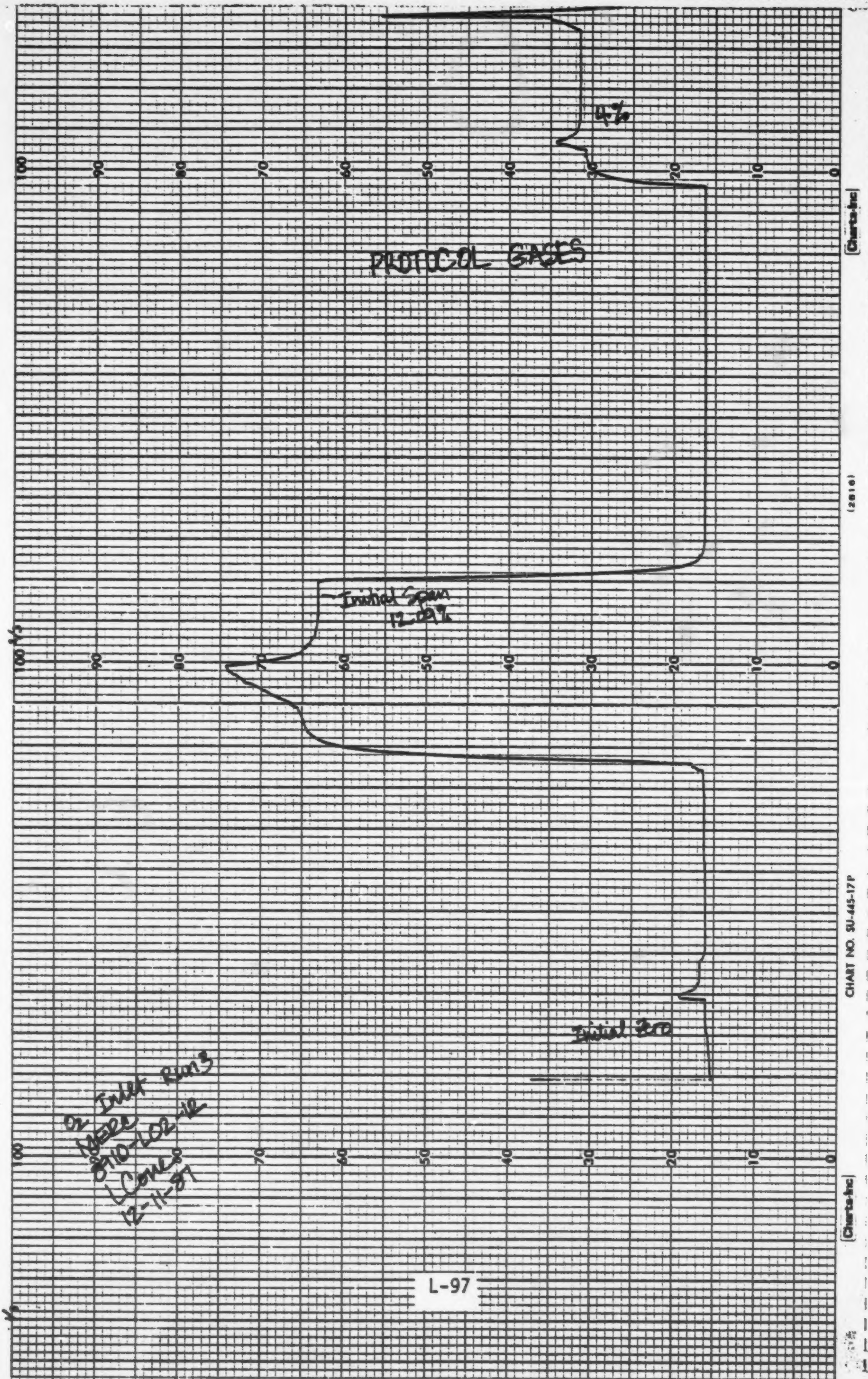
11:52   1.79   1.86   2.66   3.07  27.33
11:52  -0.23   0.05    3.2    0.0   86.9

11:53   1.86   1.89   2.65   3.07  27.55
11:53  -0.21   0.05    3.1    0.0   87.9

11:54   2.44   1.90   2.49   3.10  27.44
11:54  -0.06   0.05    2.2    0.0   87.4

11:55   2.64   1.99   2.48   2.98  27.43
11:55  -0.01   0.05    2.1   -0.0   87.4

11:56   2.80   1.93   2.47   2.91  27.46
11:56   0.03   0.05    2.0   -0.0   87.5 ←— 93.1 ppm SO2
MR3AIN
MERC RUN 3A INLET
12-11-1987
INLET
8910-L02-12
LCONE
```



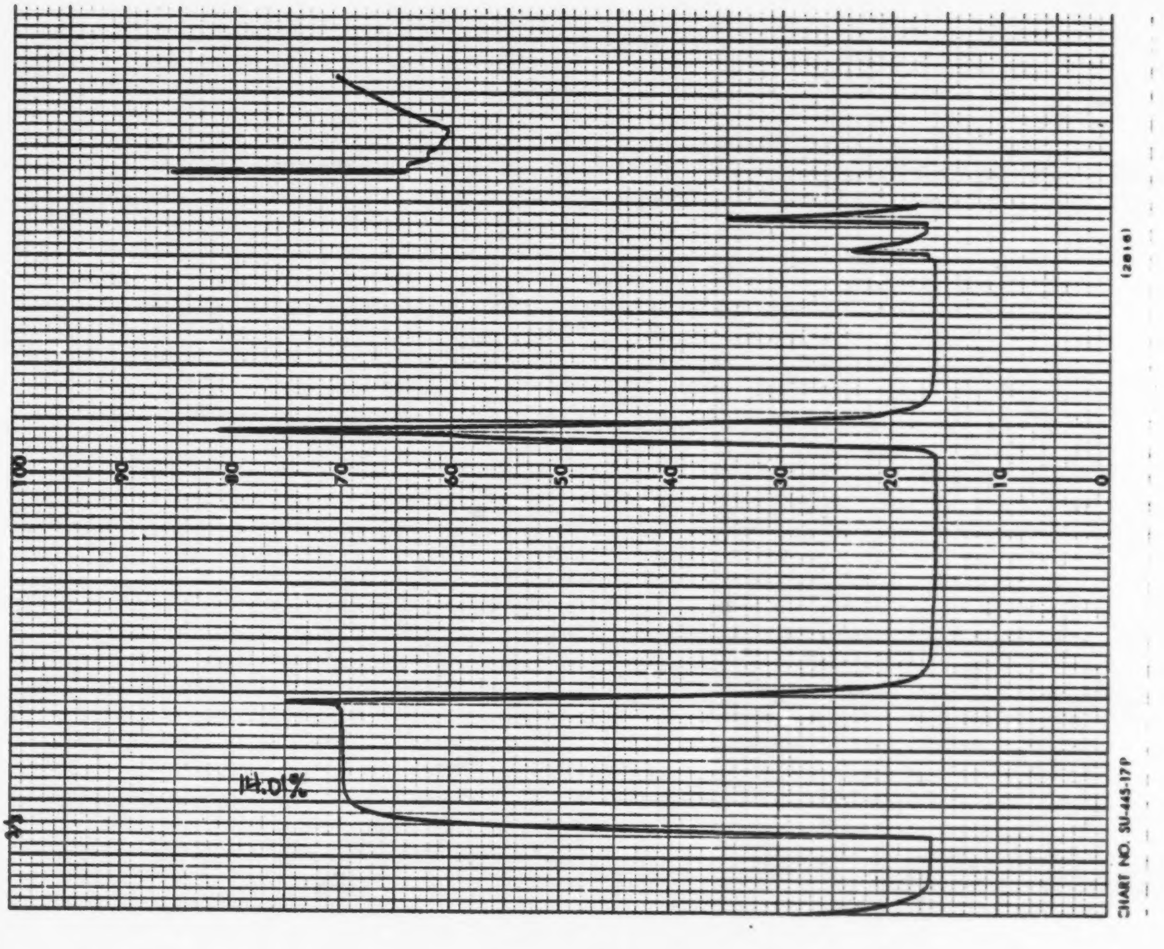
4%

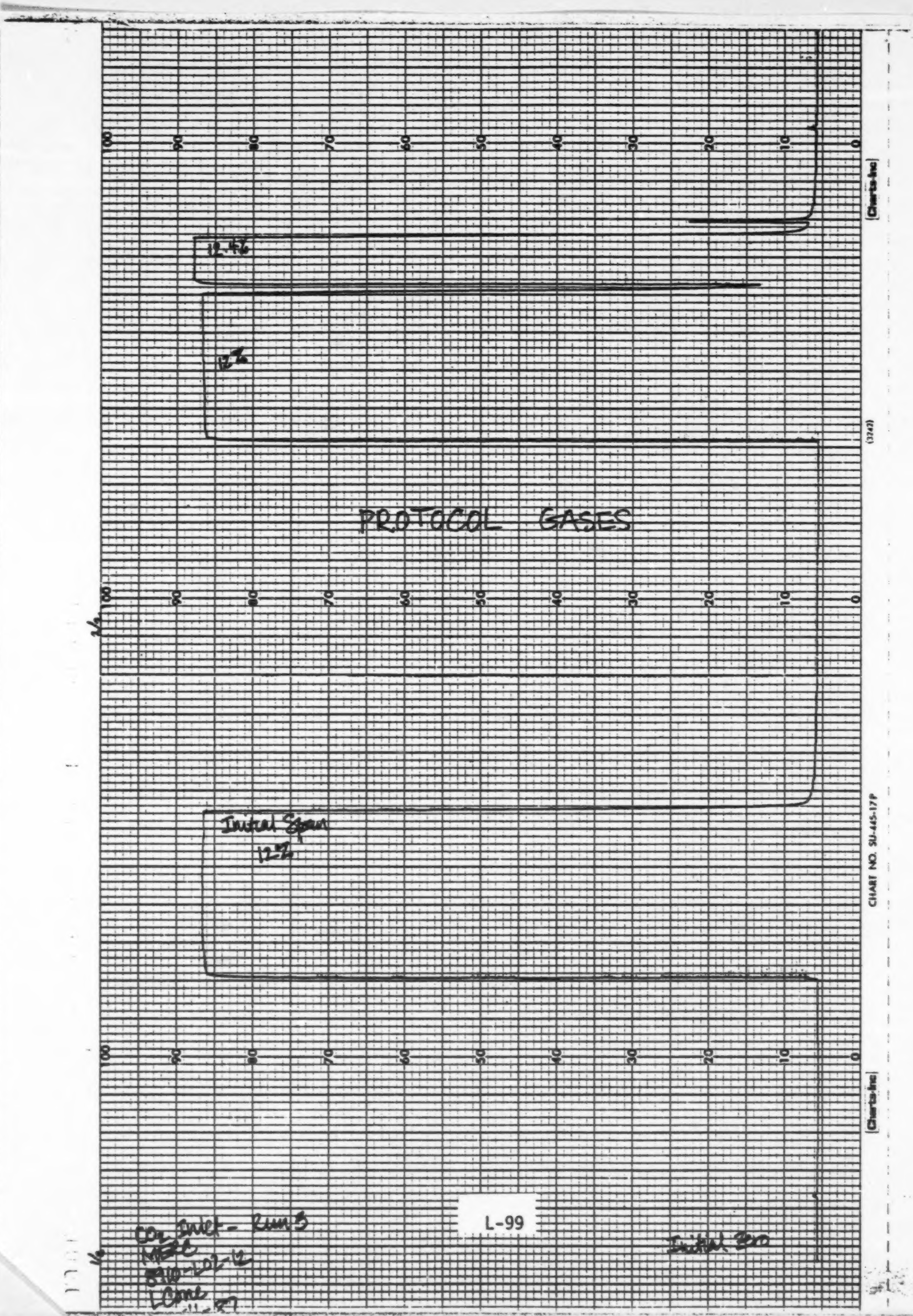
PROTOCOL GASES

Initial Span
12.09%

Initial Zero

O2 Inlet Runs
MERC
8910-L02-12
L Cones
12-11-89


100
90
80
70
60
50
40
30
20
10
0
14.01%
CHART NO. SU-445-17P
(2616)



12.4%

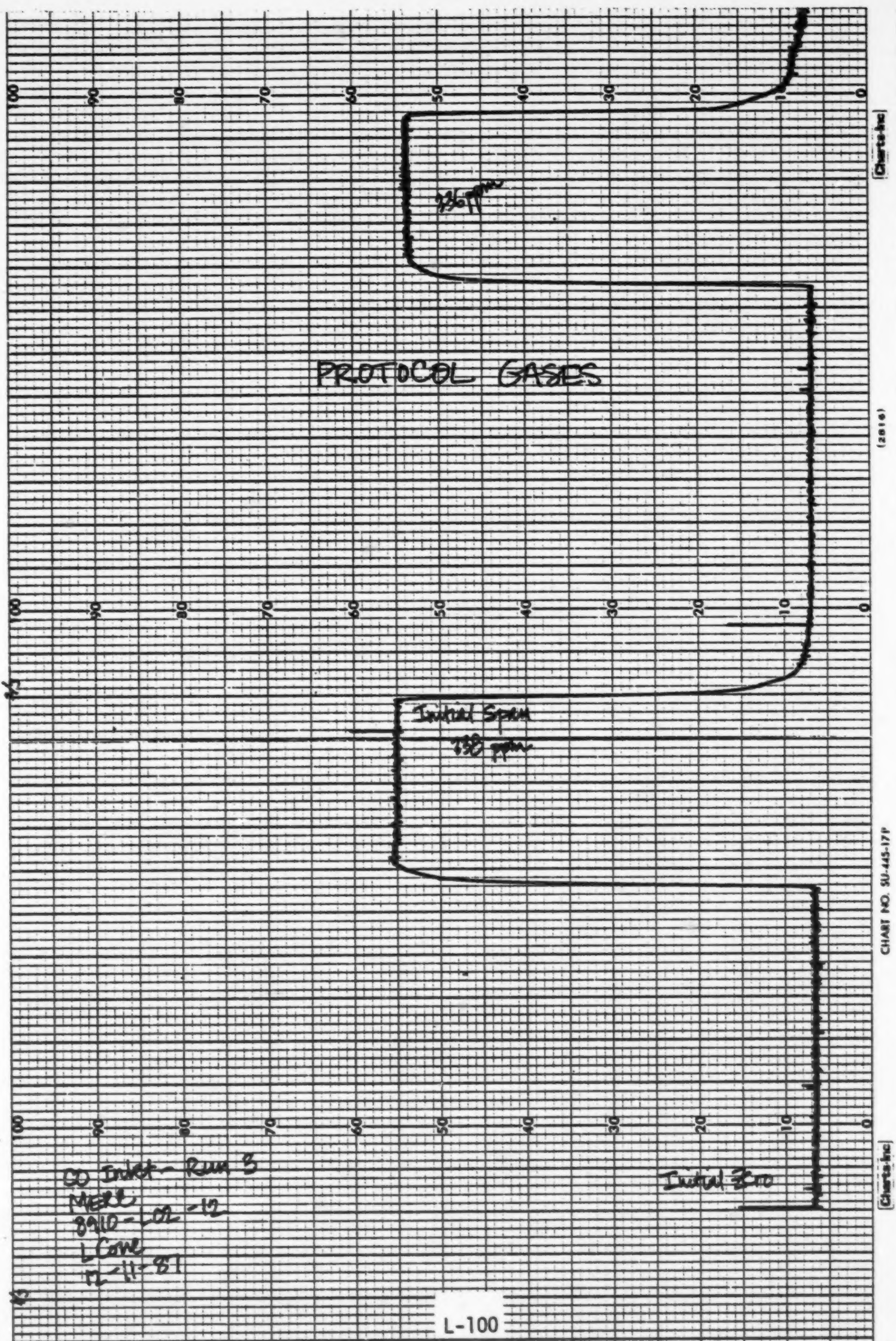
12%

PROTOCOL GASES

Initial Span
12%

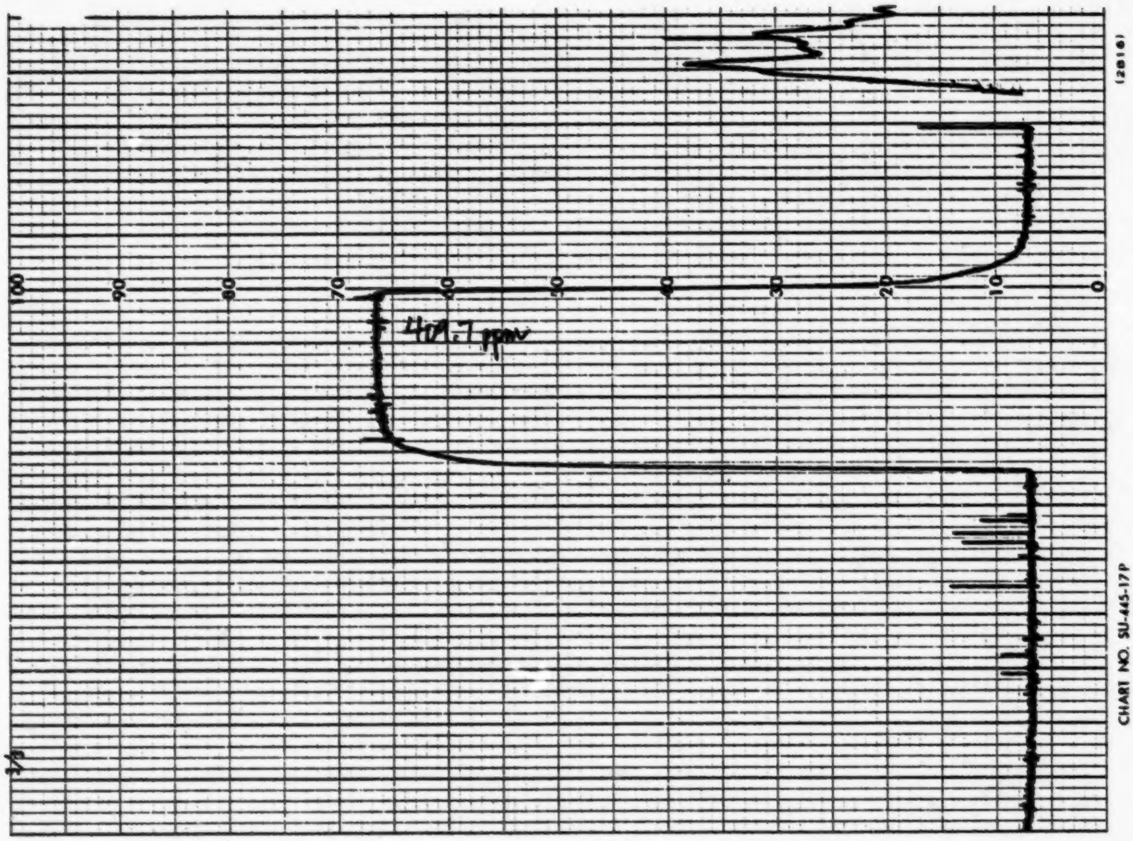
CO2 Inlet - Run 3
MERC
5910-L02-12
LCane
-11-87

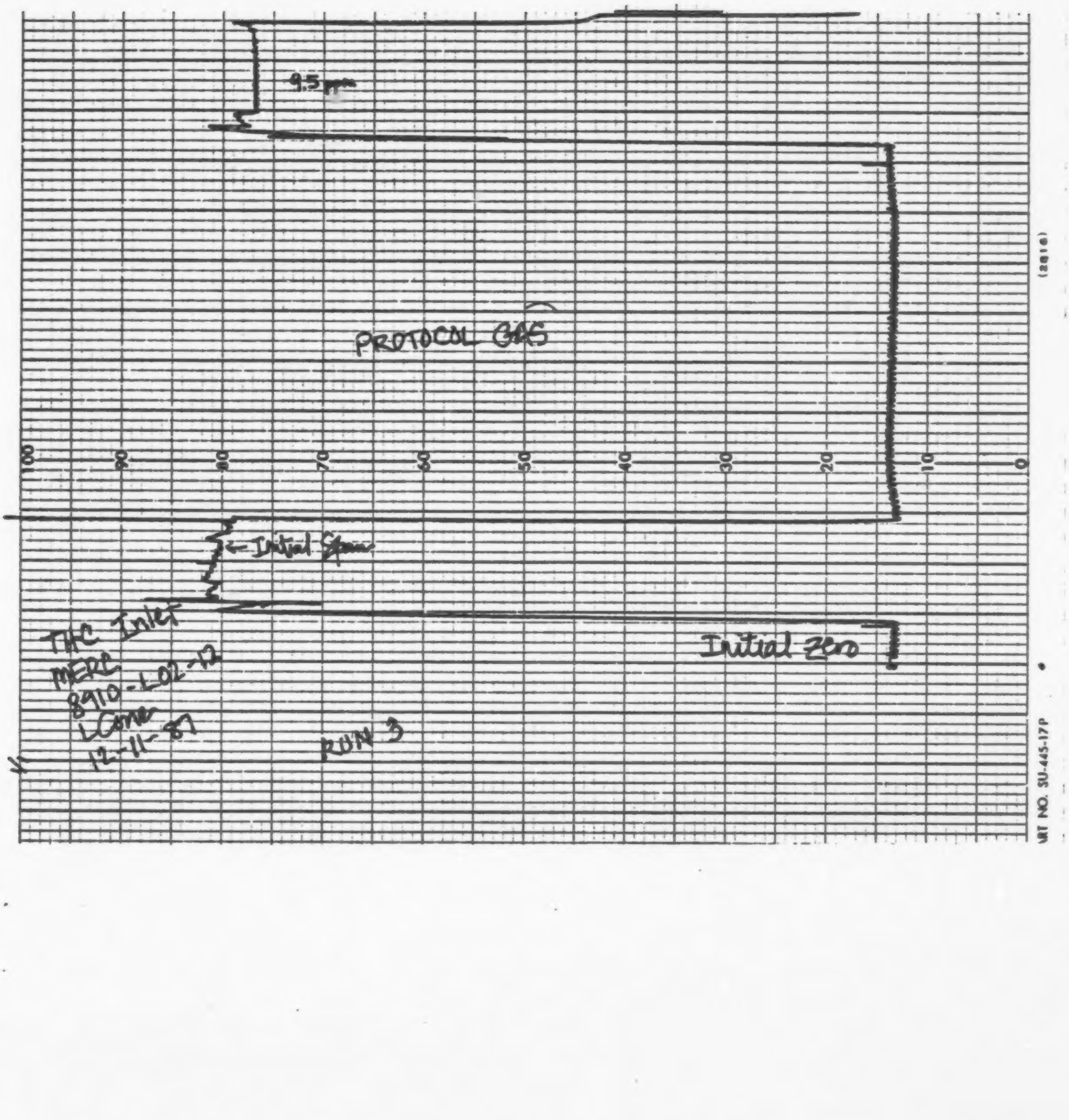
Initial Zero

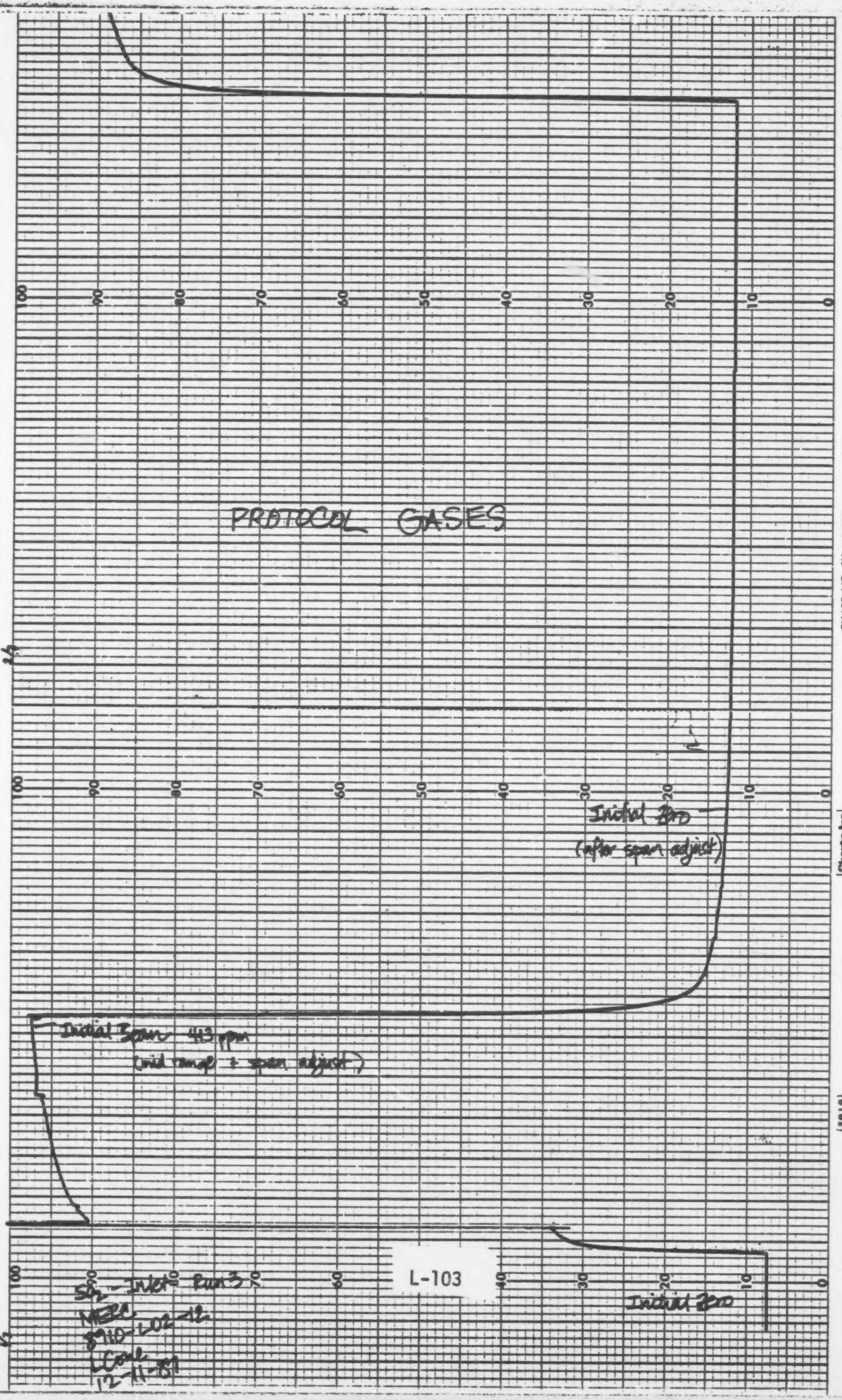


PROTOCOL GASES

CO Inlet - Run 3
MERC
8910-L02-12
L Cone
12-11-87


100
90
80
70
60
50
40
30
20
10
0
409.7 ppmv
CHART NO. SU-445-17P
(2816)


9.5 ppm
PROTOCOL GAS
← Initial Span
Initial Zero
THC Inlet
MERC
8910-L02-12
LComer
12-11-87
RUN 3
100
90
80
70
60
50
40
30
20
10
0
(2818)
RT NO. SU-445-17P



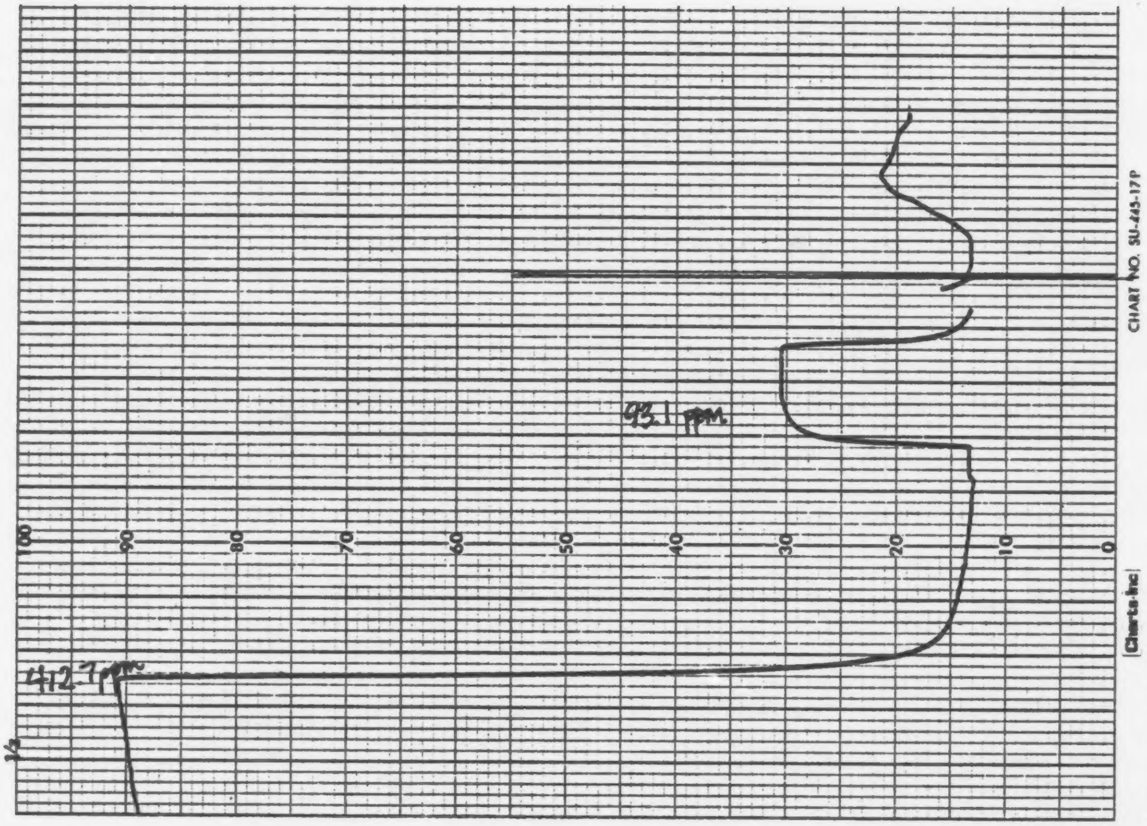
PROTOCOL GASES

Initial Zero
(after span adjust)

Initial Span 413 ppm
(mid range + span adjust)

Initial Zero

SO_2 - Inlet - Run 3
MEEC
8910-L02-12
L Cole
12-11-89


100
90
80
70
60
50
40
30
20
10
0
93.1 ppm.
412.7 ppm
1/3
CHART NO. 5U-445-17P
Charts-Inc

10:14. Lk chk ok

```
RUN#3 MID MERC
12/11/87
MIDPOINT
8910-L02-12
GWS
08:34
 0  O2    1.53
 1 CO2    3.33
08:35
 0  O2    1.39
 1 CO2    2.25
08:36
 0  O2    1.32
 1 CO2    1.75
08:37
 0  O2    1.27
 1 CO2    1.45
08:38
 0  O2    1.24
 1 CO2    1.34
08:39
 0  O2    1.19
 1 CO2    1.27
08:40
 0  O2    1.13
 1 CO2    1.21
08:41
 0  O2    1.10
 1 CO2    1.19
08:42
 0  O2    1.02
 1 CO2    1.18
08:43
 0  O2    0.99
 1 CO2    1.17
08:43             IN ZERO
 0  O2    0.99
 1 CO2    1.17
08:45
 0  O2   53.44
 1 CO2   51.27
08:46
 0  O2   51.98
 1 CO2   71.38
08:47
 0  O2   49.97
 1 CO2   76.32
08:48
 0  O2   49.27
 1 CO2   77.38
08:49
 0  O2   48.88
 1 CO2   77.67
08:50
 0  O2   48.72
 1 CO2   77.76
08:51
 0  O2   48.49
 1 CO2   77.34
08:52
 0  O2   48.39
 1 CO2   77.90
08:53
 0  O2   48.29
 1 CO2   77.91
08:53             IN SPAN
 0  O2   48.29      12.09
 1 CO2   77.91      12.00
```

```
10.43 75.20
 2.41 11.27
  2 10:22
 1.47 76.45
 0.12 11.61
  3 10:23
 1.22 77.42
 0.06 11.87
  4 10:24
 1.12 77.84
 0.03 11.98
  5 10:25
 1.13 78.02
 0.04 12.03
  6 10:26
 1.05 78.14
 0.02 12.06
  7 10:27
 1.03 78.07
 0.01 12.04
  8 10:28
 1.02 78.07
 0.01 12.05
  9 10:29
 0.97 78.07
-0.00 12.05
 10 10:30
 0.97 78.14
-0.00 12.06
 11 10:31
 0.91 78.13
-0.02 12.06
 12 10:38
51.32 19.94
12.86  1.32
 13 10:39
51.10 12.93
12.81  0.72
 14 10:40
50.97  7.73
12.77  0.37
 15 10:41
50.88  4.91
12.75  0.21
 16 10:50
31.06 35.15
 7.69  3.13
 17 10:59
17.34 65.58
 4.18  8.87
 18 11:00
15.96 75.78
 3.83 11.41
 19 11:01
15.62 77.22
 3.74 11.81
 20 11:02
15.58 77.69
 3.73 11.94
 21 11:03
15.53 77.78
 3.72 11.96
 22 11:04
15.54 77.81
 3.72 11.97
 23 11:05
15.48 77.83
 3.70 11.98
```

Post cyl
Bal 3172
12.40%
CO2

Post cyl
BAL 336
14.01%
O2

Old std

[illegible] chk ok

```
RUN#2 MERC
12/10/87
MIDPOINT
8910L02-12
GWS
08:31
 0  O2    3.35
 1 CO2    2.86
08:32
 0  O2    0.75
 1 CO2    2.12
08:33
 0  O2    0.73
 1 CO2    1.93
08:34
 0  O2    0.74
 1 CO2    1.83
08:35
 0  O2    0.72
 1 CO2    1.80
08:36
 0  O2    0.72
 1 CO2    1.78
08:37
 0  O2    0.70
 1 CO2    1.77
08:38
 0  O2    0.67
 1 CO2    1.75
08:39
 0  O2    0.66
 1 CO2    1.72
08:40
 0  O2    0.67
 1 CO2    1.72
08:41
 0  O2    0.62
 1 CO2    1.74
08:42
 0  O2    0.66
 1 CO2    1.70
08:43
 0  O2    0.65
 1 CO2    1.71
08:44
 0  O2    0.50
 1 CO2    1.70
08:45
 0  O2    0.60
 1 CO2    1.66
08:46
 0  O2    0.58
 1 CO2    1.65
08:47
```

```
 1 CO2    1.60
08:47             IN ZERO
 0  O2    0.58
 1 CO2    1.60
08:50
 0  O2   20.86
 1 CO2   72.65
08:51
 0  O2   17.84
 1 CO2   76.84
08:52
 0  O2   16.82
 1 CO2   77.54
08:53
 0  O2   16.69
 1 CO2   77.73
08:54
 0  O2   16.63
 1 CO2   77.82
08:55
 0  O2   16.64
 1 CO2   77.85
08:55             IN SPAN
 1 CO2   77.85      12.00
09:14
 0  O2   56.58
 1 CO2    3.11
09:15
 0  O2   55.51
 1 CO2    2.42
09:16
 0  O2   55.39
 1 CO2    2.15
09:17
 0  O2   55.31
 1 CO2    2.02
09:17             IN SPAN
 0  O2   55.31      14.01
   1 10:00
60.38 59.59
15.31  7.51
   2 10:01
63.86 54.11
16.20  6.36
   3 10:02
66.81 47.26
16.95  5.06
   4 10:03
66.49 46.38
16.87  4.89
   5 10:04
66.43 46.14
16.86  4.86
   6 10:05
63.96 50.37
16.22  5.63
   7 10:06
54.38 64.71
13.77  8.67
   8 10:07
64.89 54.12
16.46  6.36
   9 10:08
53.16 66.09
13.46  8.39
  10 10:09
51.96 66.06
13.15  8.98
  11 10:10
47.37 60.29
11.98  7.66
  12 10:11
47.53 58.49
12.02  7.27
  13 10:12
51.50 59.10
13.03  7.40
  14 10:13
41.71 46.41
10.53  4.91
  15 10:14
58.41 38.35
14.08  3.58
  16 10:17
```

```
MR3OUT
run #3 merc
12-11-1987
MERC OUTLET
8910-L02-12
BWS
                0        1         2        3
           O2       CO2      SO2      NOx
08:41           0.55     0.85     2.88     1.91
08:42           0.54     0.82     2.79     1.85
08:43           0.50     0.83     2.70     1.86
08:44           0.49     0.82     2.67     1.77
08:45           0.46     0.83     2.65     1.77
08:46           0.45     0.83     2.63     1.77
08:47           0.44     0.82     2.61     1.80
08:48           0.44     0.84     2.59     1.75
08:49           0.43     0.82     2.58     1.80
08:49 INIT. ZERO
 0   O2    0.43
 1  CO2    0.82
 2  SO2    2.58
 3  NOx    1.80
09:06          46.89    82.19     3.04     1.68
09:07          46.64    82.25     2.95     1.69
09:08          46.49    82.24     2.86     1.66
09:09          46.42    82.26     2.83     1.66
09:09 INIT. SPAN
 0   O2  46.42      12.09
 1  CO2  82.26      12.00
09:15           0.47     1.09     5.71    50.90
09:16           0.43     1.07     5.73    49.46
09:17           0.42     1.01     5.74    49.27
09:18           0.39     0.97     5.76    49.06
09:19           0.39     0.95     5.80    49.16
09:20           0.38     1.05     5.79    49.73
09:21           0.37     0.99     5.79    50.05
09:22           0.35     0.98     5.85    49.97
09:22 INIT. SPAN
 3  NOx  49.97     107.80
09:29           0.49     0.96    50.12    26.77
09:30           0.35     0.99    57.71     7.03
09:31           0.32     0.92    62.21     2.26
09:32           0.31     0.99    65.29     1.87
09:33           0.29     0.99    67.48     1.79
09:34           0.29     0.99    69.23     1.76
09:35           0.29     0.93    70.63     1.71
09:36           0.30     0.93    71.89     1.69
09:37           0.28     0.91    72.74     1.61
09:38           0.27     0.93    73.71     1.60
09:39           0.28     0.93    74.43     1.61
09:40           0.27     0.97    75.12     1.56
09:41           0.27     0.93    75.68     1.61
09:42           0.26     0.99    76.14     1.59
09:43           0.26     0.96    76.47     1.58
09:44           0.26     0.94    76.94     1.61
09:45           0.25     0.94    77.38     1.58
09:46           0.25     0.93    77.72     1.60
09:47           0.26     0.91    78.06     1.55
09:48           0.25     0.95    78.30     1.54
09:49           0.24     0.96    78.56     1.60
09:50           0.25     0.89    78.87     1.51
09:51           0.24     1.05    79.11     1.57
09:52           0.23     0.96    79.36     1.53
```

```
09:53           0.24     0.91    79.65     1.52
09:54           0.25     0.98    79.70     1.54
09:55           0.24     0.97    79.94     1.53
09:56           0.23     0.96    80.14     1.51
09:57           0.23     0.98    80.34     1.51
09:58           0.23     0.92    80.43     1.48
09:59           0.23     0.91    80.49     1.45
10:00           0.23     0.96    80.57     1.49
10:00 INIT. SPAN
 2  SO2  80.57      93.10

10:01    0.22     1.00   33.46     1.51
10:01   -0.06     0.05    36.9    -0.6

10:02    0.23     0.95   27.06     1.53
10:02   -0.05     0.05    29.2    -0.6

10:03    0.21     0.99   27.12     1.55
10:03   -0.06     0.05    29.3    -0.6

10:04    0.22     0.95   27.14     1.49
10:04   -0.06     0.05    29.3    -0.7

10:05    0.22     0.95   27.17     1.51
10:05   -0.05     0.05    29.3    -0.6

10:06    0.22     0.96   27.19     1.48
10:06   -0.05     0.05    29.4    -0.7

10:07    0.20     0.92   27.22     1.48
10:07   -0.06     0.05    29.4    -0.7

10:08    0.22     0.87   27.23     1.46
10:08   -0.06     0.05    29.4    -0.8

10:09    0.21     1.02   27.28     1.49
10:09   -0.06     0.05    29.5    -0.7

10:14    0.27    83.59    7.18     1.50
10:14   -0.04    12.34     5.5    -0.7

10:15    0.27    83.63    5.13     1.56
10:15   -0.04    12.36     3.0    -0.5

10:16    0.25    83.60    3.96     1.51
10:16   -0.05    12.35     1.6    -0.6

10:17    0.25    83.68    3.32     1.49
10:17   -0.05    12.37     0.9    -0.7

10:18    0.24    83.70    2.86     1.46
10:18   -0.05    12.38     0.3    -0.8

10:42    0.33     1.03    0.63     1.46
10:42   -0.03     0.05    -2.3    -0.8

10:43    0.32     1.08    0.63     1.44
10:43   -0.03     0.06    -2.3    -0.8

10:44    0.31     1.13    0.57     1.44
10:44   -0.03     0.06    -2.4    -0.8

10:45   48.75     1.30    0.65     1.58
10:45   12.70     0.06    -2.3    -0.5

10:46   52.57     1.15    0.56     1.46
10:46   13.71     0.06    -2.4    -0.8

10:47   54.11     1.14    0.57     1.50
10:47   14.11     0.06    -2.4    -0.7

10:48   54.28     1.12    0.59     1.38
10:48   14.16     0.06    -2.4    -0.9

10:49   54.35     1.07    0.57     1.42
10:49   .14.17    0.06    -2.4    -0.9

10:51   30.61    73.18    0.68     1.30
10:51    7.93     9.78    -2.3    -1.1
```

← SO2 [illegible] chk on med range

← Pert CO2 12.40% BAL 3172

← SO2 zero chk on med range

← Pert O2 [illegible] BAL 536

← old std [illegible] O2 13 [illegible] CO2

```
10:52  19.24  80.59    0.65    1.46
10:52   4.94  11.58   -2.3    -0.8

10:53  16.57  82.11    0.60    1.60
10:53   4.24  11.96   -2.4    -0.4

10:54  16.46  82.26    0.54    1.41
10:54   4.21  12.00   -2.4    -0.9

10:55  16.40  82.26    0.51    1.38
10:55   4.20  12.00   -2.5    -0.9

10:56  16.27  82.22    0.51    1.43
10:56   4.16  11.99   -2.5    -0.8

11:30   2.33   1.23   93.91    1.80
11:30   0.50   0.06  109.0     0.0

11:31   0.98   1.19  102.22    1.65
11:31   0.14   0.06  119.0    -0.3

11:32   0.74   1.19  105.67    1.48
11:32   0.08   0.06  123.1    -0.7

11:33   0.67   1.19  107.78    1.45
11:33   0.06   0.06  125.6    -0.8

11:34   0.59   1.27  109.26    1.42
11:34   0.04   0.06  127.3    -0.8

11:35   0.56   1.25  110.38    1.45
11:35   0.03   0.06  128.7    -0.8

11:36   0.50   1.21  111.20    1.42
11:36   0.02   0.06  129.7    -0.9

11:37   0.48   1.14  111.90    1.42
11:37   0.01   0.06  130.5    -0.9

11:38   0.47   1.20  112.53    1.42
11:38   0.01   0.06  131.3    -0.9

11:39   0.43   1.22  113.10    1.39
11:39   0.00   0.06  131.9    -0.9

11:40   0.44   1.20  113.59    1.42
11:40   0.00   0.06  132.5    -0.9

11:41   0.41   1.17  113.95    1.40
11:41  -0.01   0.06  132.9    -0.9

11:42   0.40   1.20  114.30    1.40
11:42  -0.01   0.06  133.4    -0.9

11:43   0.38   1.24  114.49    1.40
11:43  -0.01   0.06  133.6    -0.9

11:44   0.38   1.19  114.67    1.40
11:44  -0.01   0.06  133.8    -0.9

11:45   0.37   1.29  114.99    1.41
11:45  -0.02   0.06  134.2    -0.9

11:46   0.36   1.24  115.18    1.41
11:46  -0.02   0.06  134.4    -0.9

11:47   0.36   1.15  115.43    1.39
11:47  -0.02   0.06  134.7    -0.9

11:48   0.35   1.19  115.57    1.39
11:48  -0.02   0.06  134.9    -0.9

11:49   0.34   1.16  115.83    1.40
11:49  -0.02   0.06  135.2    -0.9

11:50   0.34   1.18  116.11    1.39
11:50  -0.02   0.06  135.5    -0.9

11:51   0.33   1.20  116.33    1.39
11:51  -0.03   0.06  135.8    -0.9
MR3AOUT
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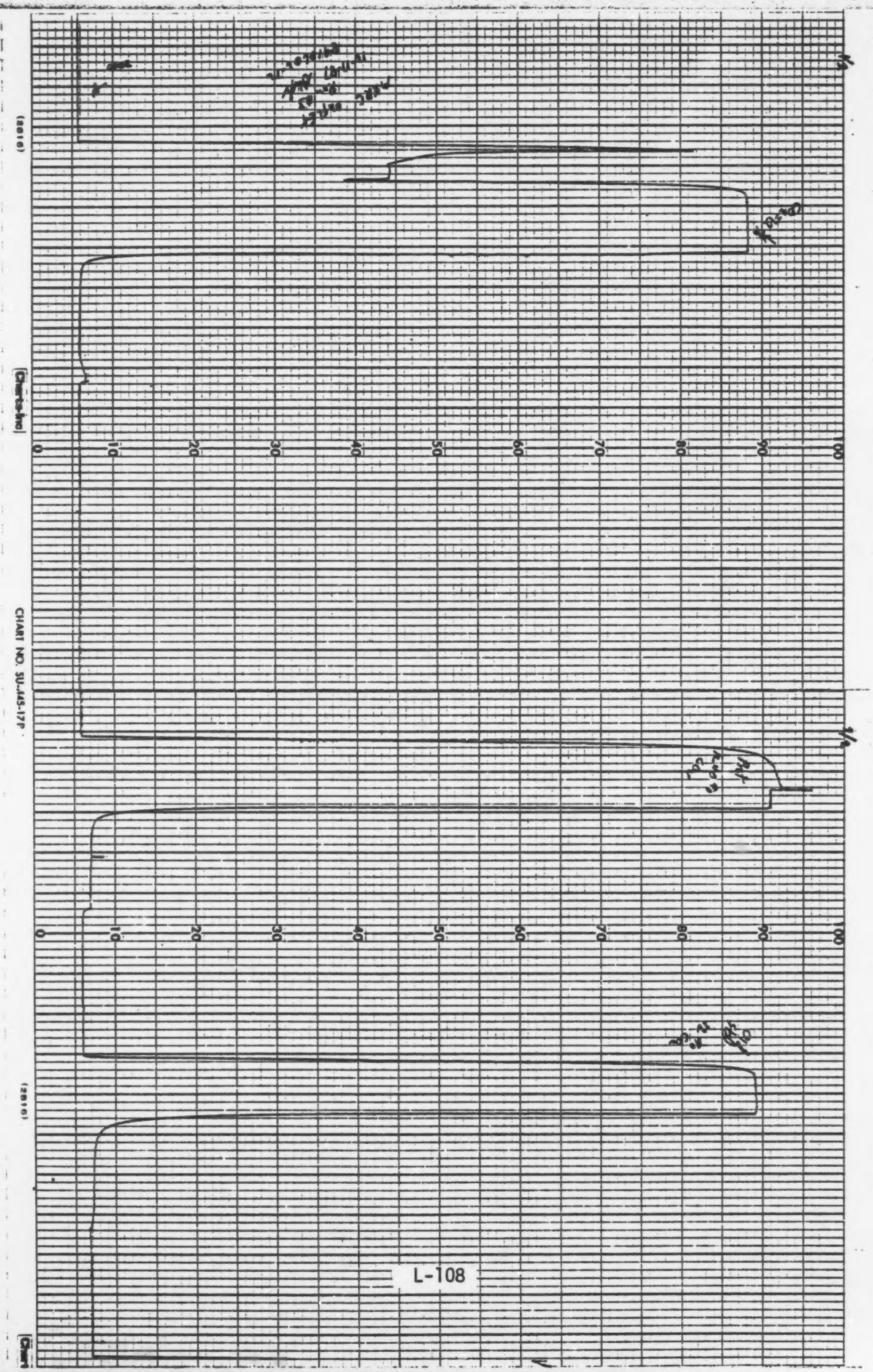
BAL 1907
506-4127


(2010)
Charts-Inc
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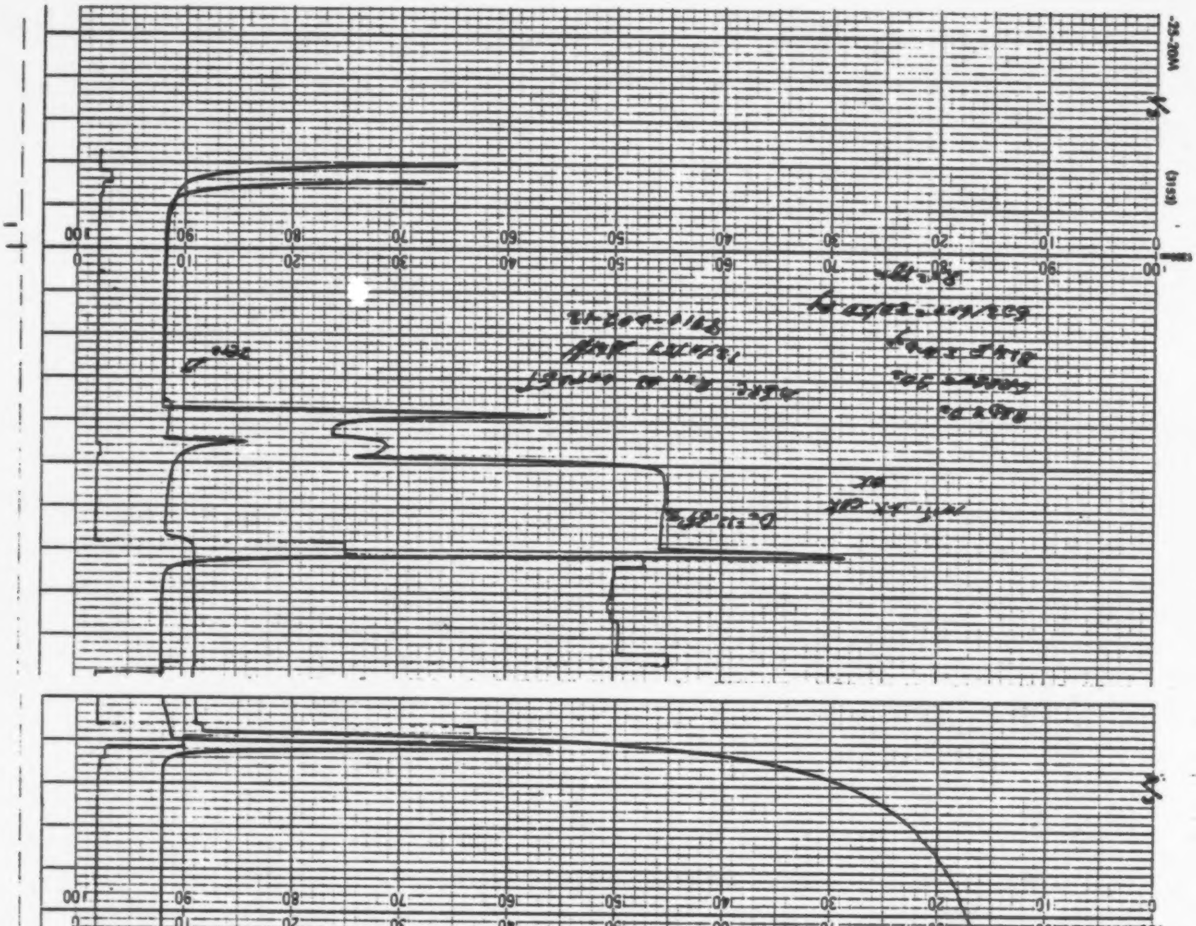
100
(2010)
Chart

L-108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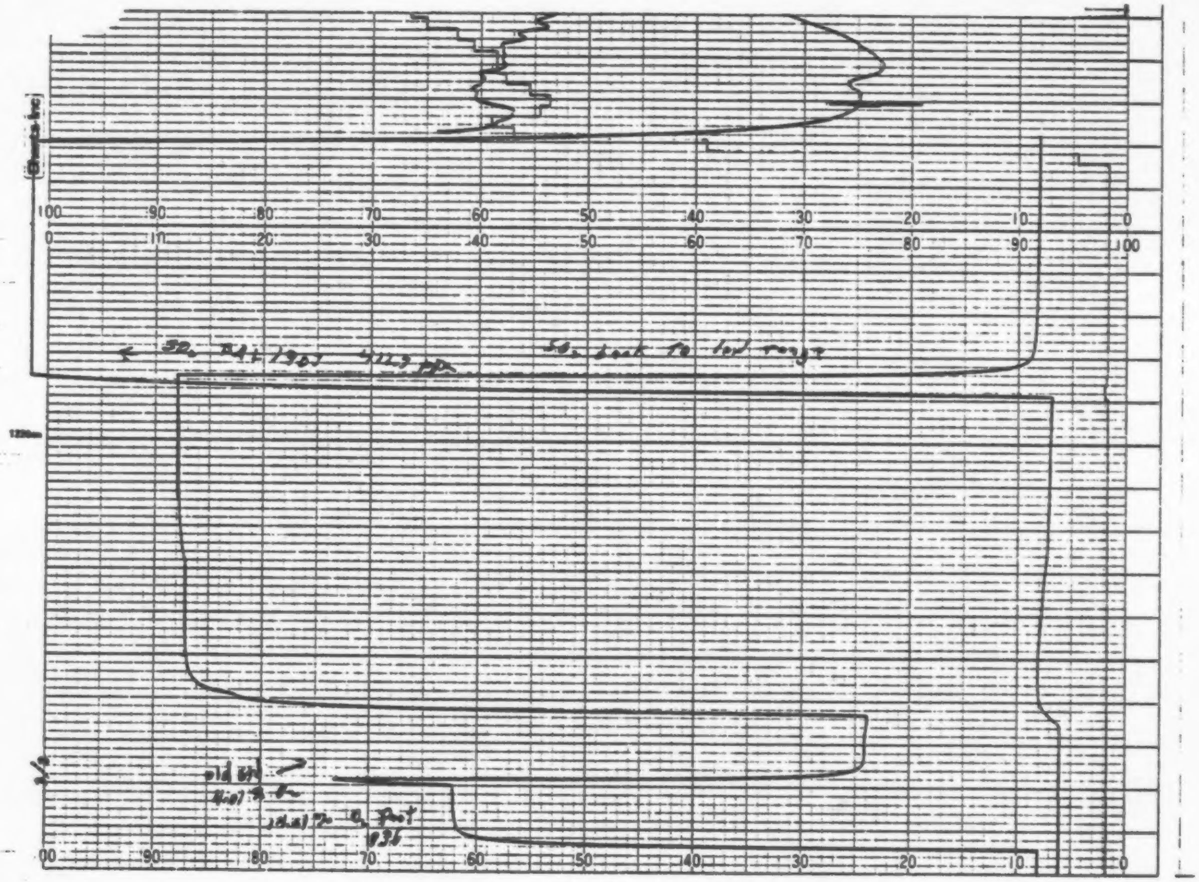
Zero
SO₂ zero


100
90
80
70
60
50
40
30
20
10
0
← 32, 844 1907 4119 ppm
50, back to low range
old std →
0936

L.10 EPA Audit Reports

RESEARCH TRIANGLE INSTITUTE

RTI Project 433U-3967-03

FINAL
AUDIT REPORT

Prepared by

Keith A. Daum
Joseph D. Evans

Audit Description

Audit Type:	Technical Systems
Date Audit Performed:	December 8 and 9, 1987
OAQPS Project Officer:	Clyde E. Riley
AEERL Project Officer:	Theodore G. Brna
Audit Location:	Maine Energy Resource Company Biddeford, Maine
Organization Audited:	Midwest Research Institute and Entropy Environmentalists, Inc.
Project Audited:	Emission Testing at a Refuse-Derived Fuel (RDF) Municipal Waste Combustor
Project QTRAK ID:	87031/II

Performed for

Judith S. Ford
Quality Assurance Officer
Air and Energy Engineering Research Laboratory
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711
Under EPA Contract No. 68-02-4291

March 25, 1988

POST OFFICE BOX 12194 RESEARCH TRIANGLE PARK, NORTH CAROLINA 27709-2194

RTI Project 433U-3967-03

FINAL
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Audit Type:	Technical Systems
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March 25, 1988

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Appendix A MERC Audit Checklist for Biddeford, Maine.................A-1

1.0 INTRODUCTION

1.1 PURPOSE OF AUDIT

The purpose of this audit was to evaluate project activities during the test burn of refuse-derived fuel (RDF) in the municipal waste combustor (MWC) at the Maine Energy Resource Company (MERC) in Biddeford, Maine. The Office of Air Quality Planning and Standards (OAQPS) has requested quality assurance (QA) support for the RDF-MWC test program. As the QA support contractor for AEERL, Research Triangle Institute (RTI) has worked with the AEERL QA Officer, Mrs. Judith Ford, to provide support to OAQPS for this program.

RTI's responsibility was to develop a checklist (included as Appendix A) to be used by OAQPS and AEERL technical personnel in order to perform a technical systems audit for on-site sampling and measurements. Since no quality assurance project plan was available for the collection of process data, only general questions were asked about this subject. The completed checklist was returned to RTI after the test burn and has been used as the basis for this audit report. RTI personnel were not in Maine for this audit. RTI will perform an on-site technical systems audit of the analysis of polychlorodibenzodioxins (PCDDs) and polychlorodibenzofurans (PCDFs) at MRI in Kansas City, and a separate audit report will be written.

1.2 AUDIT SUMMARY

For the on-site sampling and analysis, the recommended rating is "acceptable with recommendations." These recommendations are based on answers to questions in the audit checklist. Potential problems concerning solid sampling and continuous emission monitors are discussed in section 3.0. Since no procedures were available for the collection of process data, the scope of these audit questions was of a general nature. Without complete knowledge of the process data collection goals and procedures, there can be no basis for an audit evaluation. For this reason, there is no recommended rating for the collection of process data; however, some general recommendations are discussed in section 3.0. The checklist was completed by Mr. Ted Brna (AEERL-EPA) and Mr. Gene Riley (OAQPS) while they were on-site in Biddeford, Maine, on December 7, 8, and 9, 1987.

1.3 DESCRIPTION OF THE PROCESS AUDITED

The test program at the Maine Energy Resource Company in Biddeford, Maine, a Babcock and Wilcox incineration unit with a spray dryer/fabric filter (SD/FF) emission control system, will provide EPA with the initial data for regulatory development at RDF-MWC facilities.

Specific objectives of the Biddeford test program are

1. To determine the level of uncontrolled MWC emissions, including criteria pollutants, metals, acid gases, and dioxins/furans, from a state-of-the-art RDF facility under normal operating conditions or under normal variations in facility operation.

2. To determine the control efficiency of RDF-MWC emissions, including criteria pollutants, metals, acid gases, and dioxins/furans, of a spray dryer/fabric filter control system.

Entropy Environmentalists, Inc., conducted continuous emission monitoring for HCl at the inlet to the spray dryer, at the outlet to the spray dryer, and at the outlet to the fabric filter. Midwest Research Institute (MRI) performed manual sampling for PCDD/PCDF, particulate matter, metals, O_2, and CO_2 at the spray dryer inlet and the fabric filter outlet. MRI also conducted continuous emission monitoring for CO, CO_2, SO_2, and THC at the spray dryer inlet; CO_2 and O_2 at the spray dryer outlet; and NO_x, SO_2, CO_2, and O_2 at the fabric filter outlet. Sampling of the fly ash, lime slurry, and RDF was also to be conducted or coordinated by MRI.

Process and control system data were collected over the course of the test program. This included all computer-logged process data from the plant instrumentation and all available emission control system parameters. If available, CEM data will be retrieved from the plant's computerized CEM data acquisition system which monitors concentrations of CO, CO_2, SO_2, and stack opacity.

1.4 SUPPORTING DOCUMENTATION

The checklist was designed to cover all sampling and measurements which may have an impact on the final presentation of data. These included operating conditions, process data collection, Method 5 train operation, continuous emission monitoring, solid sampling, HCl sampling and analysis, and general questions. No QA project plan was available for the collection of process data. The technical basis for the checklist was developed from the following:

1. Quality Assurance Project Plan and Site Specific Work Plan: "HCl Monitoring for Refuse-Derived Fuel Municipal Waste Combustor Test Program." Entropy Environmentalists, Inc., December 1987.

2. Quality Assurance Plan and Test Plan: "Emissions Testing at an RDF Municipal Waste Combustor." Midwest Research Institute, November 1987.

3. Quality Assurance Handbook for Air Pollution Measurement Systems (EPA-600/4-77-0276).

4. Handbook--Continuous Air Pollution Source Monitoring Systems (EPA-625/6-79-005).

1.5 PRE-AUDIT ACTIVITIES

During the first of December 1987, Dr. Shri Kulkarni (RTI) discussed with Mrs. Judith Ford (AEERL-EPA) and Mr. Gene Riley (OAQPS-EPA) RTI's QA responsibility for the municipal waste incineration emission measurements program. Sampling at the Biddeford, Maine, plant was to begin the second week of December. A schedule was therefore proposed for QA activities at several plants (including Biddeford). The QA activities would include sampling and analysis at various sites across the United States over a 6-month period. It was decided that because of cost limitations, RTI would not perform an audit at Biddeford, Maine, but would instead prepare an audit checklist to be completed by Mr. Riley and Mr. Ted Brna (AEERL-EPA) who were traveling to Biddeford to witness the sampling operation.

2.0 PRESENTATION OF CHECKLIST INFORMATION

2.1 OVERVIEW

There were seven areas covered by the audit checklist: operating conditions, process data collection, Method 5 trains, continuous emission monitors, solid sampling and analysis, questions for Entropy, and general questions. The following sub-sections present information from the audit checklist which was completed by personnel on-site in Biddeford, Maine.

2.2 OPERATING CONDITIONS

In general, all of the expected average values of operating conditions for the process, emission control system, and flue gas data are reasonable values for operating conditions at an MWC. Analysis of the collected process data can verify that the expected average values were achieved; however, a couple of items from the checklist are noteworthy. In Checklist Section I.A. Process Parameters, the ID fan flue gas inlet temperature (baghouse outlet) is listed as 281°F, while in Section I.B. Emission Control System, the fabric filter outlet temperature is listed as 265°F. Also, the air heater outlet temperature is listed as 350°F and the dry scrubber inlet temperature as 375°F.

In Checklist Section I.C. Flue Gas Data, an opacity of up to ten (10) percent was noted as the upper limit during the test. According to a memorandum from Mr. Riley (OAQPS) to Ms. Judith Ford (AEERL-EPA), the actual opacity during the three test runs did not exceed 0.5 percent. The checklist value was in error. The opacity value of 0.5 percent is a reasonable value for this type of system.

The sampling procedures in the QA Project Plan (QAPP) described taking one ash sample from the middle of six hoppers of the baghouse (Figure 1-1 in the QAPP). Since there may be size segregation of ash along the three hoppers and since PCDD/PCDF and metals may preferentially absorb to some size classes of ash, it is probably important to at least verify that particle size segregation does not exist. Additional review of the sampling procedures and of the completed checklist confirms that there has been no verification that particle size segregation does not occur in the baghouse.

2.3 PROCESS DATA COLLECTION

As described in section 1.1, no QAPP was available for process data collection and therefore, the checklist questions were of a general nature. The responses in this section state that plant instruments will be used for collection of process data. The test plan indicates that the plant O_2 sensor is located near the beginning of the system. In-leakage of air at the cyclone, spray dryer, baghouse, and preheater may add to the air flow at the stack, and gas volumes at test points may increase nearer the stack. According to the memorandum from Mr. Riley, it is understood that CO_2 will be used to standardize emissions data and that air leakage is usually within tolerance limits of volumetric flow measurement devices (5 to 10 percent).

2.4 METHOD 5 TRAIN

Method 5 trains were used by MRI to collect for particulates and metals and a Modified Method 5 train was used to collect for organics. Originally several organics, including PAHs, were to be analyzed by MRI. Due to legal restrictions placed upon this project, however, the only organics which will be analyzed are dioxins and furans. Several aspects of the train were audited including the placement of the sample probe, calibration of instruments in use, leak-checking, train set-up and tear-down, and critical operating parameters. As indicated in the checklist, there were no unusual problems which would cause the quality of data to be compromised. For additional information, refer to Section III of the audit checklist (Appendix A).

2.5 CONTINUOUS EMISSION MONITORS (CEMs)

Six gases were monitored during each test run: CO, CO_2, O_2, SO_2, NO_x, and total hydrocarbons (THC) as propane. Initial calibration was performed for each of these monitors using a zero gas and one upscale point as specified in MRI's QAPP. Quality control (QC) checks were run on a regular basis and were within ± 15% of the cylinder concentration as stated in the QAPP. Normal operation of any continuous emission monitor, however, usually requires a three-point calibration with regular QC checks at a low (or zero) value and a high (about 90%) span value. While MRI's initial calibration was only two points, they were following their proposed QA Project Plan requirements. Section IV of the audit checklist (Appendix A) concerns continuous emission monitors.

2.6 SOLID SAMPLING

The solids sampled during the test included the lime slurry feed, fly ash, and cyclone ash. Sampling techniques for each of these solids were performed using procedures established by the EPA field project manager. These procedures were not included in MRI's QAPP. Solid sampling was not performed in duplicate so there was no way of establishing sampling error. Samples will be split for analysis, however, so that analytical precision for solid samples will be assessed. Proper storage and shipping techniques were followed by MRI personnel. For further information concerning solid sampling, refer to Section V of the audit checklist (Appendix A).

2.7 HCL MONITORING

HCl was monitored in the stack gas flow by Entropy using a continuous emission monitor (CEM). Since HCl CEM techniques are not as well established as other CEMs, additional verification was performed by Entropy in order to better establish the data quality of the HCl measurements. Wet chemistry techniques to verify CEM accuracy were to be performed as part of Entropy's laboratory analysis. These results, however, were not available at the time the audit was performed. Subsequently, results of the wet chemistry techniques are reported in Entropy's Emission Test Report dated January 25, 1988. These results were questionable; therefore, Entropy decided not to use them to verify HCl concentrations. According to the report, the impinger sample results at the baghouse outlet for each run were 1 ppm HCl, while the averaged CEM measurements over the same three sampling periods were 6 ppm, 11 ppm, and 43 ppm. Operating problems which disrupted the test program also prohibited the completion of the HCl wet chemistry performance audits at the spray dryer inlet and outlet locations. (For further information concerning the HCl results, refer to Entropy's Emission Test Report.)

To establish linearity of the HCl CEM, Entropy used three separate gas concentrations, including a zero gas, as an initial calibration technique. Criteria of an "r" value $\geq$ 0.9950 for the calibration curve established by the three-point calibration were achieved by Entropy's technicians. Span and QC checks were performed as specified in Entropy's QAPP using the gases acquired for calibration. Additional information concerning Entropy's sampling techniques can be found in Section VI of the audit checklist (Appendix A).

3.0 CONCLUSIONS AND RECOMMENDATION

3.1 CONCLUSIONS

There are mismatches in the expected temperature values between the ID fan flue gas inlet and fabric filter outlet, and also the air heat outlet and dry scrubber inlet. There is no basis to evaluate the temperatures in terms of the QAPP, although an apparent loss or gain of heat would be disturbing. Conclusion: The expected temperature should be reconciled.

Sampling only from the middle hopper of the baghouse for ash adheres to procedures described in the QAPP. There may be a problem with segregation of ash by size in the six hoppers. Conclusion: There may be potential for preferential absorption of PCDD/PCDF and metals in the ash and the ash may not be distributed evenly by size class in the six hoppers.

Continuous emission monitors (CEMs) should be calibrated if at all possible with at least three different calibration gases. A zero and QC concentration can then be used as periodic checks for instrument drift. The calibration gases should bracket the expected gas concentrations. Three gas concentrations assure better instrument linearity and a correlation coefficient can only be derived with three or more points. Bracketing the expected gas concentrations is necessary to assure a linear response at all measured concentrations. Historical information on the particular CEM may give an indication of previous instrument response; however, it is best to check linearity in the field before sampling (ref. 4 in section 1.4). Conclusion: Results of previous audits performed by RTI indicate it is always best to use three different gas concentrations for CEM calibration. This applies even to CEMs that are generally known to be linear. A three-point calibration can give necessary information concerning instrument response at various concentrations that would have been overlooked if such a calibration had not been performed.

Sampling solids is very different from sampling gases or solutions and it is therefore difficult to obtain a homogeneous sample. Conclusion: For this reason, duplicate samples or even triplicate samples should be acquired. This is the only way to assess total sampling error. Often the sampling error is larger than the analytical error; so while samples are split after collection for analysis, the total precision (sampling and analytical) remains unknown and is certainly greater than the known analytical precision computed from split samples.

Previous HCl monitoring tests conducted by Entropy at similar municipal waste incinerators have shown excellent agreement between the impinger sample results and Bodenseewerk CEM measurements as claimed by Entropy in their Emission Test Report. Impinger results for this study were not used by Entropy to validate the CEM measurements. Conclusion: Because of the previous comparative studies performed by Entropy, there is probably no reason to suspect the accuracy of the HCl CEM measurements taken during this test run.

3.2 RECOMMENDATIONS

3.2.1 Operating Conditions

- Investigate and explain the temperature mismatches between the ID fan and fabric filter and between the air heater outlet and dry scrubber inlet.
- In upcoming projects, determine if there is a particle size preference for PCDD/PCDF and metals. Determine if particle size segregation is taking place from one collection hopper to the next.

3.2.2 Sampling Data

- It is recommended for future tests that CEM calibration be performed just prior to field testing using three or more gas concentrations, that criteria be established for a correlation coefficient, and that the calibration gases bracket the expected gas concentrations. It should be noted, however, that MRI was following the protocol as stated in their QAPP, which used a zero and one upscale point for all CEM calibrations.
- Protocol for solid sampling was not described in MRI's QAPP. Subsequent reporting of data from this project should include a thorough description of the protocols used. For future studies it is recommended that these procedures be included in the QAPP and, if possible, that duplicate or even triplicate samples be obtained for analysis in order to determine sampling error.

4.0 AUDITORS' STATEMENT OF AUTHORIZATION/APPROVAL OF REPORT

Report Title:	On-Site Technical Systems Audit of MRI's and Entropy's Project Entitled "Emission Testing at a Refuse-Derived Fuel Municipal Waste Combustor" (QTRAK No. 87301, Category II)
Date of Report:	March 1988
Author:	Keith A. Daum and Joseph D. Evans, Research Triangle Institute
EPA Contract No.:	68-02-4291
RTI Project No.:	433U-3967-03
Auditors:	Keith A. Daum and Joseph D. Evans of RTI Clyde E. Riley and Theodore G. Brna of EPA
Date of Audit:	December 8 and 9, 1987

Authorization and Approval:

We hereby certify that the report described above is, to the best of our knowledge, complete and accurate.

Signatures of Lead Auditors

APPENDIX A

MERC AUDIT CHECKLIST FOR BIDDEFORD, MAINE

MERC AUDIT CHECKLIST

For Biddeford, Maine

Unit A

I. OPERATING CONDITIONS

A. Process Parameters

1. List the agreed upon values for plant process parameters to be used for the test burn. Test data were to be collected under normally operated conditions. They consisted of full to near full load (105,000 lb steam/hr) and maintenance of permit (Maine) requirements.

12/9/87

Process Data From Plant Instrumentation	Units	Expected Average Value	Allowable Range *
Furnace pressure	in. w.c.	Values taken in several areas	
Furnace temperature	°F	"	
Steam flow	10^3 lb/h	105	
Steam pressure	psig	665	
Steam temperature	°F	760	
Combustion air flows Total Underfire Overfire Other	10^{3} lb/h	 136 50 79 7	
Combustion air temp. leaving air heater	°F	315	
Combustion air press.	in. w.c.	4	
Air heater outlet temp. gas air	°F	350 315	
Air heater inlet temp. gas air	°F	530 80	
Economizer flue gas inlet temp.	°F	760	
Economizer flue gas outlet temp.	°F	530	
ID fan flue gas inlet temp. = baghouse outlet flue gas temp.	°F	281	
Oxygen concentration (left + right values)/2	% by vol.	7	
Refuse feed rate calculated for HHV = 5515 Btu/lb	lb/h	26.6×10^3	
Overfire air nozzle pressures	in. w.c.	30	

* No agreed-to allowable range

I. OPERATING CONDITIONS

A. Process Parameters (continued)

Process Data From Plant Instrumentation	Units	Expected Average Value	Allowable Range
Overfire air splits #	in. w.c.		
Grate speed	fpm	0.2	≤ 0.5
Feed Boiler water temp.	°F	352	
Feed Boiler (feedwater pump disch.) water pressure	~~in. w.c.~~ psig	1100	
Feed water flow rate	~~g/m~~ 10^3 lb/hr	110	

# Meaning not clear -- pressures taken at both front and back of furnace.

2. Are these normal operating conditions? If not, how will deviations affect the representativeness of the data?
Probably -- unit has not gone to commercial operation yet. The values indicated were arrived at from earlier test data and approximate the design values.

3. What is the corrective action when plant process parameters are outside of the allowable range?
Action taken depends on process parameter. The major objectives are to maintain steam load or power generated at full rating while operating in compliance with state permit requirements. Since the heating value of the refuse-derived fuel (RDF) varies, the feed rate of the fuel is adjusted to maintain the desired steam load while holding other parameters within prescribed limits.

B. Emission Control System

1. List the agreed-upon values for operating parameters for the emission control system, during the test burn.

Emission Control Parameters	Units	Expected Average Value	Allowable Range
Dry scrubber inlet temp.	°F	375	
Dry scrubber outlet temp.	°F	275	
Dry scrubber inlet press.	in. w.c.	-7.1	
Dry scrubber outlet press.	in. w.c.	-11.0	
Fabric filter inlet temp.	°F	275	
Fabric filter outlet temp.	°F	265	
Fabric filter differential press.	in. w.c.	7.1	
Fabric filter cleaning@ cycle	min		
Dilution water feed rate	gpm	5	
Lime slurry feed rate	gpm	4.5	
Stoichiometric ratio	--	Not Available	

@ Pulse jet cleaning rate for each of six modules is activated by a set pressure drop.

2. Are these normal operating conditions? If not, how will deviations affect the represetativeness of the data?
The are the approximate normal operating values. Values may be changed before plant becomes commercial. Factors such as lime quality and cost may cause each unit be be operated at values closer to their design values.

3. What is the corrective action when emission control system parameters are outside of the allowable range?
Generally, either lime slurry feed rate or water dilution rate is changed. The former is used to regulate HCl and SO_2 removal from the flue gas, while the later is used primarily to control gas temperature entering the baghouse. However, both of these have effects on the parameters (acid gas control + gas temperature)

C. Flue Gas Data

1. List the expected values for flue gas data from plant instrumentation and the allowable range for staying within conditions specified for the test burn.

Flue Gas Data	Units	Expected Average Value	Allowable Range
Opacity	percent	≤ 10	
CO	ppm	≤ 70	
CO_2	percent	3	
O_2	percent	7	
SO_2	ppmv	≤ 30	
NO_x	ppmv	≤ 250	
Moisture	percent	15	
HCl	ppm	≤ 30	

II. PROCESS DATA COLLECTION (Radian Corp.)

UNIT A

Questions for Steve Davis
or other MERC personnel
shown by "*".

Questions	Response Yes	 No	Comments
Are plant instrument values used for process data?	X		SAME VALUES USED FOR PROCESS CONTROL
* Were plant instruments calibrated within the last 6 months? If not, list date of last calibration.	some		All sensors calibrated 3/87. Some Critical control PARAMETERS CHECKED PERIODICALLY. CHECKS PERFORMED IF SETPOINT OR measured value deviates from expected.
* Are calibration factors labeled on the instrument?	X		Sensors all have labels. Computer also has labels for those that are operator variable
Is a data logger used to collect process data?	X		MERC Has a Bailey NET 90 system, a Computer-based control and data collection system. The plant computer logs the process data
Does the data logger read directly from plant instruments?	X		And prepares a report that is transmitted to a printer port every 4 minutes. Printer Port connected to EPA Data log system
Is the length of time between readings less than 30 minutes?	X		72 variables every 4 minutes
Are data checked and verified by someone other than the person operating the data logger?	?	X	data logs spot checked by operator on site. Additional audits to be performed. LIMITED SPOT CHECKS FOR CONSISTANCY by Boiler Vendor (B&W) Representative
How are data stored?			Plant printer port interfaced to a Compaq Portable III. DATA RECORDED ON HARD DISK
Is there a back-up system for data storage?	X		HARDCOPY PRINTOUT OF ON-LINE DATA TRANSMISSIONS. BACKUP COPY OF DATA ON FLOPPY DISK
Are procedures for process data reduction available?	X		YES - performed on-site

Winton Kelly 12/12/87

III. METHOD 5 TRAIN [illegible]

a) Particulates.

Questions	Response Yes	 No	Comments
Have the dry gas meters been calibrated against a wet test meter standard?	✓		all units
Has the nozzle been calibrated to the nearest 0.025mm (0.0001 in), and has the nozzle size been properly selected?		✓	Calibrated nearest .001 inch yes properly selected for inlet/outlet test location
Are the trains correctly set up and leak-checked to less than 4% of the average sampling rate or 0.00057 m^3/min (0.02 ft^3/min), whichever is less?	✓		all sites require "0" leakage rate prior to starting testing.
Is full-stack traversing being conducted?	✓		for MM5 train and Part/metals train
Has a careful effort been made to assure that the nozzle and pitot tube are located parallel to the stack wall?	✓		~~[illegible]~~ Train alignment is positioned by mono rail and probe alignment is set by fixed slots in holders.

III. METHOD 5 TRAIN

a) Particulates (continued)

Questions	Response		Comments
	Yes	No	
Is isokinetic sampling maintained within ± 10% and checked every five minutes?	✓	✓	Individual points data not calculated; only run average data calculated
Is the sample site selection an appropriate distance downstream from any flow disturbance?	✓		Only sites available sites were checked for cyclonic flow and/or eddy current problem
Are all impingers cooled in an ice bath at all times?	✓		
Do the equipment operators have access to test protocols and methods, are data sheets available, and is equipment in good repair?	✓ ✓ ✓		

III. METHOD 5 TRAIN

b) Modified Method 5 (MM5) Addendum

Questions	Response		Comments
	Yes	No	
How has the sampling time been chosen to assure that the chance of "sample breakthrough" in the XAD cartridge is minimized?	✓		also for adequate sample
Are the resin cartridge and condenser mounted vertically on top of the first impinger?		✓	In series - 1st impg condenser XAD-2 impg
Are the filter and cyclone maintained at 120°C ± 14°C (248°F ± 25°F)?	✓		for inlet only outlet - filter only also probe
Is the sample gas entering the resin cartridge cooled to less than 20°C (68°F)?	✓		
Is the standard MM5 configuration used?	✓		Modified train used for dioxin and metals testing
Are greaseless joints and seals used in the sampling train?	✓		Threaded glassware joints with Teflon seals

III. METHOD 5 TRAIN

c) Sample Preparation, Storage, and Shipping for Method 5 and Modified Method 5 Analysis

Questions	Response		Comments
	Yes	No	
Are all openings capped during train disassembly?		✓	Not during disassembly but during removal from sites
Is the clean-up area clean and protected from the wind?	✓		60 ft trailer
What solvents are used in sample recovery and do sample recovery methods prevent contamination?	✓		Hexane, Acetone, Water 0.1N HNO_3 acidified ~~HNO_4~~ ~~KNO_4~~ $KMnO_4$
Do any visible particles remain inside the probe after rinsing?		✓	
Are sample containers labeled and sealed tight, and is the liquid level marked?	✓		
Is the XAD stored under refrigeration and is the XAD container carefully capped and stored to prevent loss of sample?	✓		Capped, wrapped in foil and stored in ice, [illegible].
Are method and solvent blanks also included for analysis?	✓		lab blanks, field blanks recovery blanks, solvent, XAD, filter blanks
What percentage of the total samples are blanks?			20%
How long are the samples stored before ~~analysis?~~ extraction			Dioxin/furan — 14 days metals — 30 days

IV. METHOD 5 CONTINUOUS EMISSION MONITORS (CEMs)

Questions	Response		Comments
	Yes	No	
Has linearity been established for each of the CEMs prior to testing?		✓	Not routinely done because of number of CEMs involved. - Only the CO and CO_2 instruments are inherently non-linear. MRI has programmed manufacturer's corrections (curves) in their computer program for processing CO and CO_2 data.
How many points were used to establish linearity for each CEM and did the gas concentrations bracket the expected analytical ranges listed? CO 0-500 ppm CO_2 0-15% O_2 0-25% SO_2 0-500 ppm TCH 0-20 ppm propane	Normally 2		Normally 0 and near full-scale or maximum value Cal. gas values for points used CO: 0 & 330 ppm CO_2: 0 & 12% SO_2: 0, 93, & 413 ppm & midpoint = inlet & outlet TCH: 0 & 10 ppm propane NO_x: 0 & 108 ppm
Do QC checks meet the required specifications for all CEMs? **Gas** — **QA Specification** CO, CO_2, O_2, SO_2, THC — ± 10% of the relative QC gas concentration		✓	MRI QC document states ± 15% is the goal.

V. SOLID SAMPLING AND ANALYSIS (MRI)

Questions	Response		Comments
	Yes	No	
Are Lime Slurry, Ash, and Refuse Derived Fuel (RDF) samples obtained by MRI?	✓		
Is there a standing (standard/operating procedure (SOP) used for collection of the above samples to assure homogeneity and representativeness?	✓		Collection procedures were established by EPA field project monitor.
Are any duplicate samples taken from each sampling location?		✓	not as duplicates. Numbers taken for different analysis
How are samples stored and shipped in order to assure preservation before being analyzed?			Dioxin stored on ice. Air tight sample containers and/or plastic bags and 5 gal. containers
What types of analyses will be performed on these samples?			See Site test Plan ash samples to be extracted and held.
What is the frequency of sampling for the solid samples?			Once per hour and/or once per day.

VI. ENTROPY

Questions	Response Yes	 No	Comments
What procedures have been used to determine if representative HCl samples are acquired?	✓		HCl calibration gas supplied to probe & check instrument. No stratification tests made for probes. Existing ports used for probes, but probe inlets were away from duct opening to limit effects of inleakage. Wet HCl samples collected to check continuous monitor readings.
Was a multipoint linearity test performed for all HCl analyzers prior to testing and did they meet the acceptance criteria as specified (R ≤ 0.9950)? Did the gas concentrations used bracket the expected analysis range?	✓ ✓		Zero and two upscale used HCl continuous monitors outlet ([illegible]) - 47 + 94 ppm HCl midpoint (Compur) - 47, 94 + 22 ppm HCl outlet (TECO) - 426 + 881 ppm HCl ↑ cal. gases used
Are span and midrange QC checks performed and do they meet specified criteria? Drift ≤ 20% of relative gas concentration or two-day drift ≤ 10% per day QC check ≤ 10% of relative gas concentration	 ✓ 	✓ ✓	No ~~[illegible]~~ calibration gases were available other than those used in calibration noted above.
Were performance audits using wet HCl techniques performed on each analyzer prior to the test program?			Low-HCl concentrations at outlet required lab analyses which were not available on site. At time of this questionnaire survey, no audits were made as sampling ports at inlet and outlet were being used for other tests. Attempts will be made to do so later during testing.
Did the above audits meet the specified accuracy criteria of ± 25% for an average of three values?			Unknown at this time

VII. GENERAL

Questions	Response Yes	 No	Relative to Procedures used by Entropy Comments
Are all samples properly labeled and is adequate sample custody performed for both MRI and ENTROPY?			Samples labeled with date, sample location, and other data keyed to log sheet for more complete identification of samples. Adequate sample custody on site.
Do the sample labels include the time the sample was collected and who collected it?			Sample label includes date sample was collected along with location and other data key to log sheet containing time of sampling and other information
Is there a designated sample custodian? For MRI? For ENTROPY?			Keith Henry (?) One of technicians employed by Entropy.
Have QA officers from ENTROPY and MRI been on-site to inspect the operation?			QA Officer for Entropy has not visited and does not plan to visit site. Team leader is very experienced and knowledgeable on HCl CEMs, having been on an EPA test program for these CEMs over the past year

More to be determined after 12/11/87.

Agreement made prior to test that QA officer for Entropy would not visit site due to limited extent of Entropy role in this test program.

RTI Project 433U-3967-03

DRAFT
FINAL
AUDIT REPORT

Auditors

Joseph D. Evans
Shrikant V. Kulkarni, Ph.D.

Audit Description

Audit Type:	Technical Systems
Data Audit Performed:	January 26 and 27, 1988
OAQPS Project Officer:	Clyde E. Riley
AEERL Project Officer:	Theodore G. Brna
Audit Location:	Midwest Research Institute Kansas City, Missouri
Organization Audited:	Midwest Research Institute
Project Audited:	Emission Testing at a Refuse-Derived Fuel (RDF) Municipal Waste Combustor
Project QTRAK ID:	87031/II

Performed for

Judith S. Ford
Quality Assurance Officer
Air and Energy Engineering Research Laboratory
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711
Under EPA Contract No. 68-02-4291

March 29, 1988

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1.0 INTRODUCTION

1.1 PURPOSE OF AUDIT

A technical systems audit (TSA) is a qualitative on-site evaluation of a measurement system. The objective of a TSA is to assess all facilities and document equipment, operation and maintenance, recordkeeping, data validation, experimental procedures, calibration procedures, reporting requirements, and quality control procedures. Since the above items should be defined in the approved quality assurance project plan (QAPP) for the project, the QAPP provides the basis for the audit. Any undocumented or unauthorized deviations from the QAPP will be noted during the audit and included in this report.

This audit was performed at Midwest Research Institute (MRI), Kansas City, Missouri, for the analysis of stack emission samples from the Maine Energy Resource Company (MERC). It included inspection of (1) sample extraction and digestion procedures of the GC/MS laboratory for analysis of polychlorodibenzodioxins/polychlorodibenzofurans (PCDDs/PCDFs), and (2) the metals analysis laboratory. The type and range of this audit was established by project and QA personnel at EPA. The intent of the audit was to identify problems in either analysis and to recommend changes to improve data quality. Previously, a field technical systems audit was performed for this same project in Biddeford, Maine.

1.2 AUDIT SUMMARY

The auditors' recommended rating is "acceptable." During the audit, the auditors observed that careful attention was given to the quality assurance project plan by all project personnel involved in sample handling and analysis. The QA Coordinator was particularly helpful and stated that he performed his own quality assurance/quality control (QA/QC) audits in each of the laboratories. No major problems were identified; however, some minor recommendations are listed in section 3.0.

1.3 RESPONSIBILITIES OF PERSONNEL AUDITED

- Dr. George Scheil, Project Leader, is responsible for daily management of the staff and is the direct liaison with EPA personnel. He oversees all project procedures as well as QA/QC procedures used during the project. He also provides additional authority, when required, to support the QA Coordinator.

- Mr. Dennis Hooton, QA Coordinator, is responsible for approval of the QA project plan, monitoring of day-to-day quality assurance activities, auditing data reports and laboratories, and reporting significant activities to the QA manager.

- Dr. John Coates, Organics Analytical Task Leader, is responsible for overseeing PCDD/PCDF extraction and analysis. His responsibility is to know the analytical requirements discussed in the QA project plan, to effectively communicate these requirements to all those involved with extraction and analysis, and to institute laboratory procedures which will meet these requirements.

- Ms. Eileen McClendon, Metals Analytical Task Leader, is responsible for overseeing metals digestion and analysis. Her responsibility is to know the analytical requirements discussed in the QA project plan, to effectively communicate these requirements to those involved with digestion and analysis, and to institute procedures which will meet these requirements. She is also responsible for tracking samples for metals analysis.

- Mr. James Surman, Field Sampling Task Leader, is responsible for overseeing sampling activities and insuring that all procedures delineated in the QA project plan are followed.

- Ms. Marilyn Whitacre, Sample Custodian, is responsible for the handling of organic samples and instituting a system for effectively tracking samples through extraction and analysis.

- Mr. Kelly Thronburg and Mr. Gil Rodolvich, GC/MS Operators, are responsible for PCDD/PCDF sample analysis, daily calibration and tuning of the GC/MS instrumentation, and general maintenance of the system.

- Mr. Rick Robson and Mr. Scott Klamm, Field Sampling Technicians, are responsible for transportation, set-up and disassembly of field sampling equipment, operation of the Modified Method 5 (MM5) sampling train, and the transport of samples to the laboratory.

1.4 DESCRIPTION OF PROJECT AUDITED

The focus of this project, "Emission Testing at an RDF Municipal Waste Combustor," is to obtain data to support regulation of emissions from refuse-derived fuel (RDF) fired boilers of the municipal waste combustion (MWC) class. The objectives of the project are listed below:

1. Characterize uncontrolled emissions from the MERC facility to support regulatory development.
2. Obtain data on control device efficiency for a spray dryer/fabric filter air pollution control system.

MRI was responsible for all sampling and analysis activities, with the exception of the HCl continuous emission monitoring system which was operated by Entropy Environmentalists, Inc.

The basic program audited by RTI included sample handling and analysis of PCDDs/PCDFs, particulates, cadmium, chromium, arsenic, lead, and mercury at the spray dryer inlet and at the fabric filter outlet.

A previous technical systems audit conducted at the sampling site in Biddeford, Maine, focused primarily on sampling operations conducted by MRI and Entropy and on process parameters in use by the Maine Energy Resource Company (MERC).

1.5 SUPPORTING DOCUMENTATION

In preparing for the audit, the following documents were used as background information:

1. Quality Assurance Project Plan: Emission Testing at a Municipal Waste Combustor (Volumes I & II). Midwest Research Institute, December 7, 1987.
2. Final Test Plan: Emission Testing at a Municipal Waste Combustor. Midwest Research Institute, December 3, 1987.
3. Quality Assurance Procedures Manual for Contractors and Financial Assistance Recipients (AEERL QA-003/87). July 1987.
4. Protocol for the Analysis of 2,3,7,8 - Tetrachlorodibenzo-p-Dioxin by High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry (EPA 600/4-86-004). January 1986.

5. On-Site Technical Systems Audit of Emission Testing at the Maine Energy Resource Company Refuse-Derived Fuel Municipal Waste Combustor, conducted by T. Brna and G. Riley. RTI Draft Final Audit Report, February 25, 1988.

1.6 PRE-AUDIT ACTIVITIES

- During the month of November 1987, Shri Kulkarni, Judy Ford, and Gene Riley met several times to discuss QA activities for the municipal waste incineration project to take place over the next six months. A tentative outline for planned audits was presented in December 1987.

- On January 5, 1988, Gene Riley called RTI to inquire about an audit in Kansas City of MRI's PCDD/PCDF analysis. It was decided that a technical systems audit would be performed by Mr. Joseph Evans and Dr. Shri Kulkarni of RTI.

- On January 5, 1988, Mr. Evans called Mr. George Scheil of MRI to discuss possible audit dates and the technical systems audit to be conducted. A later call was placed to Mr. Dennis Hooton of MRI and tentative dates of January 26 and 27 were decided upon. It was also decided that the focus of the audit would be on PCDD/PCDF and metals analysis. Mr. Gene Riley and Mr. Ted Brna of EPA were also to be present for the audit.

- Mr. Evans and Dr. Kulkarni began preparations for the audit. This included gathering and studying background information, meeting with other experts at RTI knowledgeable on these subjects, and preparing an audit checklist. Once prepared by Mr. Evans, this checklist was reviewed by Dr. Kulkarni, Dr. Eva Estes with respect to metals analysis, and Ms. Doris Smith with respect to GC/MS analysis. Appropriate comments were incorporated.

- On January 20, 1988, an audit agenda was formulated and sent to MRI personnel, Ms. Judy Ford, Mr. Ted Brna, and Mr. Gene Riley.

- On January 22, 1988, Mr. Evans received final confirmation that the GC/MS analysis was proceeding as scheduled and the audit dates of January 26 and 27 were confirmed.

2.0 DESCRIPTION OF AUDIT

2.1 AUDIT OVERVIEW

The following outline describes the activities which took place during the audit.

I. January 26, 1988

  A. Afternoon

    1. RTI auditors arrive at MRI

    2. Opening meeting

      a) Persons present

        - Mr. Joseph Evans and Dr. Shrikant Kulkarni of RTI
        - Mr. Gene Riley (OAQPS) and Mr. Ted Brna (AEERL) of EPA
        - Mr. Dennis Hooton, Dr. George Scheil, Dr. John Coates, Mr. James Surman, Mr. Scott Klamm, Ms. Eileen McClendon, Ms. Marilyn Whitacre, and Mr. Rick Robson of MRI

      b) Topics

        - Discussion of auditing procedures and intent of audit
        - Progress of digestion/extraction and analysis of the MERC samples
        - Sample handling and custody procedures
        - Particulate weighing procedures
        - Brief discussion of technical systems audit performed previously by Mr. Brna and Mr. Riley (see reference 5)

II. January 27, 1988

  A. Morning

    1. Audit of procedures and systems used for extraction and analysis of dioxins and furans

      a) Tour of appropriate laboratories

      b) Examination of records and maintenance logs

      c) Discussions with personnel

B. Afternoon

1. Audit of procedures and systems used for digestion and analysis of metals
    - a) Tour of metals laboratory
    - b) Examination of records and maintenance logs
    - c) Discussions with personnel

2. Concluding conference
    - a) Purpose
        - Discuss audit findings
    - b) Persons present
        - Mr. Evans and Dr. Kulkarni of RTI
        - Mr. Hooton, Dr. Scheil, Dr. Coates, Ms. McClendon, and Ms. Whitacre of MRI

Some details of the questions and responses given during the audit can be found in the audit checklist (Appendix A). This checklist is divided into two separate sections: GC/MS PCDD/PCDF Analysis and Metals Analysis. The checklist was completed as a result of questions posed to MRI personnel, observations made during the audit, and a review of data logs and records. Not all answers recorded on the checklist were verified by documentation.

While the auditors have attempted to make this checklist as complete as possible, it does not cover every topic discussed during the audit. This report is written with the intent of summarizing the audit completely and identifying any deviations from approved procedures observed by the auditors.

2.2 SAMPLE HANDLING AND SAMPLE CUSTODY

MRI's sample handling procedure was thoroughly discussed and found to be appropriate for the MERC samples. Records of when and how the sample was obtained and who obtained it are carefully transferred when samples change possession, along with any special or unusual handling requirements. The labeling of samples is performed so that sample tracking is easily accomplished. Sample holding areas are designated and appropriate custody records are maintained. Holding times correspond to QA project plan requirements, specific to the type of analysis performed. Holding times before analysis as specified for the MERC samples were as follows:

- 28 days for mercury analysis
- 180 days for all other metals analyses
- 45 days for PCDD/PCDF analysis

These requirements were being followed by MRI.

2.3 PCDD/PCDF ANALYSIS

All areas of extraction, analysis, and interpretation of data were reviewed by the auditors. Dr. Coates is well aware of QAPP requirements and knows the American Society of Mechanical Engineers (ASME) protocol followed by MRI for this particular analysis. Laboratory procedures are designed to prevent any sample contamination and minimize sample loss. Analysts were made aware of project specifications. Field blanks, reagent blanks, and method blanks are routinely analyzed and results are carefully examined. If problems occur showing higher-than-normal levels of contamination, appropriate corrective action is initiated. These samples, along with routine QA samples independently prepared or procured by the QA Coordinator, help verify the integrity of the system.

Preventative maintenance is implemented and maintenance records are routinely kept. Balances are calibrated yearly by manufacturer technicians and regularly checked by laboratory personnel using NBS weights. These calibration records were documented; laboratory personnel QC checks are recorded in a notebook kept beside the balance. In examining this notebook and discussing the procedure with laboratory personnel, the auditors noted that no criteria had been specified which would cause a balance to pass or fail. Therefore, laboratory personnel are intuitively expected to recognize when a balance may not be usable.

Analyses are performed by experienced GC/MS operators who routinely use standards and instrument calibration materials to verify proper analysis and quantitation. Analytical recoveries fall within specified ranges, minimum detection limits are determined, and minimum quantitation is reported as the lowest specified standard solution. MRI is taking all necessary actions to insure their PCDD/PCDF analysis is of the highest quality possible. Because questions still exist (as recognized by EPA) concerning standard operating procedures for analysis of samples with very low concentrations of dioxin and furan, Dr. Coates and the rest of the laboratory personnel collect appropriate information and communicate with colleagues across the country concerning new advances in high resolution GC/MS for PCDD/PCDF analysis.

2.4 METALS ANALYSIS

The metals laboratory performs most of the digestion for this contract, as well as all the analyses. Microwave digestion, however, is not performed by MRI since a microwave oven is unavailable. This type of digestion is subcontracted and Ms. McClendon is responsible for quality assurance of the subcontractor. As explained by Ms. McClendon, past working experience with this subcontractor indicates that data quality is not affected when this digestion is not performed by MRI. Ms. McClendon is also responsible for sample custody once samples arrive at the laboratory. Storage areas are kept secure, refrigerator temperatures are monitored daily, and computer tracking of samples has been instituted as part of the laboratory routine.

In general, most analyses are being performed using "Test Methods for Evaluating Solid Wastes" (SW-846). Mercury (Hg), however, is analyzed using cold vapor analysis as specified in MRI's QA project plan. The QA project plan also stated that digestion and analysis of the metal samples from the MM5 sampling train would be performed using the "Radian Draft Method for Trace Metal Analysis." During the audit, it was learned that while the digestion of these samples is performed according to the "Radian Draft Method," the analysis will be performed by a more widely recognized procedure (Method 6010 from SW-846). This represents a slight modification from MRI's proposed QA project plan.

The auditors were told that the metals laboratory regularly participates in interlaboratory studies, and past performances indicate that their analyses are well within the performance criteria. Standards, spiked samples, reagent blanks, and QC check samples are routinely analyzed. While the majority of these samples are within specifications, corrective action procedures are available for samples which do not pass performance criteria. Standard solutions, used for making various standard concentrations, are compared to one another between batches to insure standard integrity and are then discarded before their expiration date. Records are retained showing the source and quality of these standard solutions. All instruments within the laboratory appeared in excellent operating condition. Maintenance logs are kept with the instruments and are separate from data log books. Balances are calibrated yearly and checked regularly by laboratory personnel using NBS weights. Documentation for these procedures was examined by the auditors. As with the GC/MS laboratory, there are no set criteria that a balance must pass to be considered usable. Ms. McClendon estimated that all weighings are well within one-half percent accuracy. Preventative maintenance appears to be a regular part of laboratory routine as well as laboratory technical systems audits which the auditors were told are performed by Mr. Hooton.

2.5 PARTICULATE WEIGHING

While there is no checklist included to cover this section of the audit, several questions concerning particulate weighing were posed to appropriate personnel. It was determined from conversation with the technicians that procedures specified in MRI's QAPP were followed. Personnel were aware of operating procedures instituted to insure the quality of data produced. Auditors were told that criteria for constant weight determinations were instituted as part of the laboratory routine. QC weights are used daily to check balances and these data are recorded. All data reported as a part of the particulate weighing activity are checked by the laboratory supervisor.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 CONCLUSIONS

The review of systems and procedures being used by MRI for analysis of the MERC samples indicates that reliable data will be reported. There are some minor recommendations presented; however, they should not significantly affect data quality. These recommendations should be considered by MRI for future analysis of MM5 samples as well as similar types of projects which could involve the metals and GC/MS laboratories.

It is the auditors' opinion that good quality assurance procedures have been instituted for this particular program at MRI. The observations made by the auditors, some of which are included in this report, indicate personnel are concerned with the quality of data produced as a result of measurements made inside the laboratory.

3.2 RECOMMENDATIONS

- It is recommended that MRI identify in their final report that the analysis and digestion of metal samples were not performed as specified in their QA project plan. As discussed in section 2.4, all metals analyses are being performed using Method 6010 from SW-846.
- Criteria for balance QC checks should be established in both laboratories. Presently it is generally understood that balances are accurate to within one-half of one percent. Simple and direct specifications should be noted on the balance log books in order for the laboratory analyst to know that there is a problem with balance calibration when he or she performs a balance QC check.

4.0 AUDITORS' STATEMENT OF AUTHORIZATION/APPROVAL OF REPORT

Report Title: Laboratory Technical Systems Audit of MRI's Project Entitled "Emission Testing at a Refuse-Derived Fuel Municipal Waste Combustor" (QTRAK No. 87301, Category II)

Date of Report: March 1988

Author: Joseph D. Evans,
Research Triangle Institute

EPA Contract No.: 68-02-4291

RTI Project No.: 433U-3967-03

Auditors: Joseph D. Evans and Shrikant V. Kulkarni of RTI

Data of Audit: January 26 and 27, 1988

Authorization and Approval:

I hereby certify that the report described above is, to the best of my knowledge, complete and accurate.

Signature of Lead Auditor

APPENDIX A

TECHNICAL SYSTEMS AUDIT CHECKLIST

APPENDIX A.1

GC/MS PCDD/PCDF ANALYSIS

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

GC/MS PCDD/PCDF ANALYSIS

Audit Subject: GC/MS PCDD/PCDF Analysis
Date: 1/28/88
Contractor: MRI
Lead Auditor: J.D. Evans
Location: MRI, Kansas City
Auditor Affiliation: RTI

Audit Question	Response			Comments
	Yes	No	N/A	
A. General				
What parts of the MM5 train are analyzed for PCDDs and PCDFs? Particulate filters? XAD? Solvent rinses?	X			All Front half and Back half
B. Laboratory Procedures				
Is the GC/MS calibrated with PFK or equivalent every eight hours or for each new series of analysis?	X			
Are duplicate samples analyzed? (one in 20)	X			According to QAPP
Are isotope spiked samples used? For every analysis?	X			
Does the laboratory participate in an interlaboratory QC program? Are performance samples periodically evaluated?	X	X		Intralaboratory QC
Are field blanks analyzed? (What % of the time?)	X			According to QAPP
Are reagent blanks analyzed? (What % of the time?)	X			According to QAPP
Are native PCDD and PCDF QC samples checked at regular intervals? (one in 20)	X			Checked by D. Hooton (QAC)
How are QC data maintained? Are they ordered up to date so that trends and results are easy to see?	X			

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

GC/MS PCDD/PCDF ANALYSIS

Date: ____________________

Audit Question	Response			Comments
	Yes	No	N/A	
C. Laboratory Facilities and Equipment				
Are all instruments and equipment in good operating condition?	X			
Are written SOPs available for all instruments and procedures?	X			Summarized for log book and these summaries direct analyst to referenced material
Is glassware properly cleaned according to the laboratory SOP including the rinsing of glassware with a high purity solvent prior to use?	X			
Does a schedule for preventive maintenance exist?	X	X		GC - yes (Instrument Service Pool) MS - No, as needed
Are QC procedures for maintaining and servicing equipment available?	X			
Are inspections and maintenance of facilities and equipment conducted regularly? (By whom, and who receives reports?)	X			
Does the QAO inspect records for equipment, consumables, and services? (How frequently, and what corrective action is taken?)	X			
How often are balances calibrated? Does the balance readability meet the requirement of 0.0001g?	X			Once a year
Is the GC column injection split/splitless and is column integrity checked at 8-hour shifts or for every series of analysis?	X			

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

GC/MS PCDD/PCDF ANALYSIS

Date: ____________________

Audit Question	Response			Comments
	Yes	No	N/A	
C. Laboratory Facilities and Equipment (continued)				
MS parameters for 4 ion monitoring sequence; dwell time/ion-mass = 100 msec, min. num. data pts./chromatographic peak = 7			X	Analyzing all PCDDs, PCDFs
D. Sampling				
For sampling and sample custody, refer to metals checklist				
E. Analysis				
Did an unreasonable period of time elapse between sample collection, extraction, and analysis? (Specify length of time.)				Within 45 days as stated in QAPP
Under what conditions were samples stored prior to analysis (e.g., temperature, light, and humidity)?				refrigerated as specified controlled temperature and light
Are the QC procedures specified in the QA Project Plan being implemented?	X			
Are sample preparation and extraction procedures documented and implemented accordingly?	X			
Are analytical procedures and associated SOPs documented and implemented accordingly?	X			
Are calculations verified? (Describe.) NOTE: Compound identification including GC retention window.	X			
Are control samples used to ensure that valid data are being generated?	X			

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

GC/MS PCDD/PCDF ANALYSIS

* Spiking of XAD before being sent to Field is not done at MRI but at Radian

Date: ____________________

Field Blanks and Method Blanks analyzed according to QAPP

Audit Question	Response			Comments
	Yes	No	N/A	
E. Analysis (Continued)				
Were field spikes used to assess loss due to storage, handling, and chemical analysis?		X		No Field spikes Samples are spiked prior to analysis
Are the identities of the specific instruments used in the study documented?	X			
Are the detection limits of instrumentation appropriate for the samples under investigation? Min. quantitation limit for 2,3,7,8-TCDD: 10 pg/g; other PCDDs/PCDFs: 20 pg/g.				Minimum quantitation is lowest std. unless otherwise requested by client
Is an instrument log or record maintained describing when the instrument was used and its condition?	X			
If microprocessors or laboratory data management systems are used, are hard copies available?	X			
If problems arise with instrument performance, do instrument logs or records record the pertinent information?	X			
Are sample recoveries between 60-140%?		X		Some recoveries are as low as 45%
Is the analytical precision within 60%?				NOT DONE IN LAB DATA WAITING TO BE ANALYZED
Is the molecular ion abundance ratio within proper specifications (e.g., for 2,3,7,8-TCDD: $\frac{m/z\ 319.897}{m/z\ 321.984}$ should be between 0.67 and 0.90).	X			

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

GC/MS PCDD/PCDF ANALYSIS

Date: ______________________

Audit Question	Response			Comments
	Yes	No	N/A	
E. Analysis (Continued)				
Are three calibration standards used for quantitation, and do they bracket the actual concentrations of 2,3,7,8-TCDD and total PCDF/PCDD?	X			
Are di-phenyl ethers monitored for interference (see Table 1)?	X			
Is the signal to noise ratio for 2,3,7,8-TCDD > 2.5?	X			MDL defined as 2.5 x S/N
F. Standards and Reagents				
Are standards or reference materials available to perform periodic QC checks?	X			
Are the source and quality of all standards or reference materials documented?	X			
Are standard solutions, reagents, and solvents appropriately labeled?	X			
Are records retained for the source of standard solutions, solvents, reagents, etc.?	X			even glassware used is recorded
Are records available for the source and purity of solvents, reagents, etc.?	X			records are kept and reviewed
Are standards or reference materials discarded after the recommended shelf life has expired?	X			
Are background reagents and solvents run with every series of samples?	X			

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

GC/MS PCDD/PCDF ANALYSIS

Date: ____________________

Audit Question	Response			Comments
	Yes	No	N/A	
G. Identification Criteria for 2,3,7,8-TCDD and other TCDDs				
1. Identification criteria for 2,3,7,8-TCDD:	X			
Retention time (RT) (at maximum peak height) of the sample component m/z 319.897 is within -1 to +3 seconds of the m/z 331.937 ^{13}C 2,3,7,8-TCDD internal standard peak.	X			
NOT MONITORED The ion current responses for m/z 258.930, 319.897, and 321.894 must reach a maximum simultaneously (±1 second) and must be ≥ 2.5 times noise level.	X			Use M+4 instead of 258.930 (CO/Cl loss)
The m/z 319.897/321.894 ratio ≥ 0.67 and ≤ 0.90.				.61 - .91 (ASME 505C)
The m/z 331.937/333.934 ratio ≥ 0.67 and ≤ 0.90.				.61 - .91
The S/N ratio for m/z 331.937 and 333.934 is ≥ 2.5.	X			
2. Identification Criteria for other TCDDs:				
Retention time must fall into window established by GC performance check.	X			
NOT MONITORED The ion current responses for m/z 258.930, 319.897, and 321.894 reach a maximum simultaneously (±1 second) and are ≥ 2.5 times noise level.				M+4 instead (see above)
The m/z 319.897/321.894 ratio is ≥ 0.67 and ≤ 0.90.				.61 - .91
Results documented with appropriate SIM traces and calculations.	X			

APPENDIX A.2

METALS ANALYSIS

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

METALS ANALYSIS

Audit Subject: Metals Analysis (MERC)
Contractor: MRI
Location: MRI, Kansas City
Date: 1/27/88
Lead Auditor: J. D. EVANS
Auditor Affiliation: RTI

Audit Question	Response			Comments
	Yes	No	N/A	
A. General				
Is the metals analysis being performed for the MM5 train, Bottom Ash, Cyclone Ash, and the lime slurry (Cd, Cr, As, Hg, Pb)	X			
What methods are being used for the above analysis?				ICAP - SW-846, Graphite Furnace AAS Hg cold vapor analysis
B. Laboratory Procedures				
Is the calibration of instruments and equipment performed according to the QA Project Plan?	x			
Are duplicate samples analyzed? What % of the time? (One in ten for ICAP; all samples for AAS graphite furnace and cold vapor Hg analysis) Are analysis within 20% of one another?		X		SW-846 methods are being used for analysis not the Radian Draft Method
Are triplicate samples analyzed? (One every ten, AAS graphite furnace) Are analysis within 20% of one another?		X		↓
Does the laboratory participate in an interlaboratory QC Program? Are results available for auditors to review. Describe.	X			Results of interlab studies have been within passing criteria

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

METALS ANALYSIS

Date: ______________________

	Response			
Audit Question	Yes	No	N/A	Comments
B. Laboratory Procedures (continued)				
Are standards prepared for MM5 analysis as specified in Section 4 of MRI draft plan? ICAP: One standard and blank per calibration curve AAS graphite furnace: four standards per curve Criteria for correlation coefficient? Note ranges for standard curve Cd Cr As Hg Pb	X X X			As specified in QAPP
Are recoveries for spiked samples between 80-120%? (What action is taken if they are not?)	X			
Are field blanks analyzed? What % of the time?	X			20%
Are reagent blanks analyzed? What % of the time?	X			As specified in QAPP
Is calibration of ICAP checked once per hour? Is it within 10% of calibration curve?	X			
Is the AAS re-calibrated once every 10 to 12 samples?	X			
Are separate QC samples used for cold vapor Hg analysis?	X			All analyses use separate QC samples
C. Laboratory Facilities and Equipment				
Are all instruments and equipment in good operating condition?	X			

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

METALS ANALYSIS

Date: ______________________

Audit Question	Response			Comments
	Yes	No	N/A	
C. Laboratory Facilities and Equipment (continued)				
Are written SOPs available for all instruments and procedures?	X			
Is glassware properly cleaned according to the laboratory SOP? (Soaked in nitric acid solution for 8 hours)	X			
Does a schedule for preventative maintenance exist?	X			Maintenance log kept w/ instrument
Are QC procedures for maintaining and servicing equipment available? (Note if records are maintained)	X			↓
Are inspections and maintenance of facilities and equipment conducted regularly? (By whom, and who receives reports?)	X			by QAC
Does the QAO inspect records for equipment, consumables, and services? (How frequently, and what corrective action is taken?)	X			
How often are balances calibrated?				yearly - checked before use with class S weights - Note balance check has no "real" specs ± 1/2 %
D. Sampling				
Were samples adequately labeled, and were sample custody requirements, as specified in the QA Project Plan, implemented?	X			
Is there a standard operating procedure or other source of documentation which describes the organization's sample custody procedures?	X			

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

METALS ANALYSIS

STARTED SAMPLING
12-9 sample holding
time 45 days for
Dioxins/Furans

Date: ____________________

Audit Question	Response			Comments
	Yes	No	N/A	
D. Sampling (continued)				
Are records available of when, how, and where the sample was collected?	X			Chain-of-custody record follows sample. A copy of this record is kept by each lab involved.
Are records available of who collected the sample?	X			
Are records available of who collected the sample and how the sample was prepared and transported to the laboratory?	X			
Are records available of when the samples were prepared and transported to the laboratory, and of who performed this task?	X			
Is there someone designated as the sample custodian?	X			M. Whittiker / Director (organics)
Is there a designated receipt location for samples in the laboratory?	X			
Are the date and condition of the sample upon receipt documented?	X			
Are samples individually identified by number or code so that they can be traced?	X			
Is there a system for documentation of the history of the sample after it has been logged into the laboratory? (Describe.)	X			NOTEBOOK kept in lab

* Samples collected for once
Transported four days

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

METALS ANALYSIS

Date: ______________________

Audit Question	Response			Comments
	Yes	No	N/A	
D. Sampling (continued)				
Are records available of when the sample was extracted and analyzed, and of who performed these tasks?	X			
Once analysis has been completed, are records available of the fate of the remainder of the sample (e.g., storage or disposal)?	X			kept for one year
Were deviations from all SOPs or protocols properly documented?				No Deviations
Are 4 separate fractions being analyzed (see figure)?				
Fraction 1 all metals	X			
Fraction 2 all metals	X			
Fraction 3 Hg (total volume recorded?)	X			
Fraction 4 Hg	X			
Was the liquid level marked before being shipped?	X			
E. Analysis				
Was the analysis performed in accordance with the QA Project Plan?	X			
Did an unreasonable period of time elapse between sample collection, extraction, and analysis? (Was there a specific time specified?)		X		28 Days For Hg 180 Days For all others
Under what conditions were samples stored prior to analysis (e.g., temperature, light, and humidity)?				• refrigerator for original samples • Digested samples stored in temp. controlled lab
Are sample preparation and extraction procedures documented and implemented accordingly?	X			

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

METALS ANALYSIS

Date: ______________________

Audit Question	Response			Comments
	Yes	No	N/A	
E. Analysis (continued)				
Are analytical procedures and associated SOPs documented and implemented accordingly?	X			
Are control samples used to ensure that valid data are being generated?	X			Control samples are stds. From separate companies plus interlab QC
Are the identities of the specific instruments used in the study documented?	X			
Are the detection limits of instrumentation appropriate for the samples under investigation?				
ICAP 0.02 ppm Cd	X			
0.05 ppm Cr	X			
0.1 ppm Pb	X			
0.2 ppm As	X			
AAS graphite furnace				
0.001 ppm	X			
cold vapor Hg analysis 0.5 ppb	X			
Samples should contain 10 times detection limit.	X			
Is an instrument log or record maintained describing when the instrument was used and its condition?	X			
If microprocessors or laboratory data management systems are used, are hard copies available?	X			
F. Standards and Reagents				
Are standards or reference materials available to perform periodic QC checks?	X			Interlab QC Std. From two separate companies compared
Are the source and quality of all standards or reference materials documented?	X			

TECHNICAL SYSTEMS AUDIT
QUALITY ASSURANCE AUDIT CHECKLIST

METALS ANALYSIS

Date: ______________________

Audit Question	Response			Comments
	Yes	No	N/A	
F. Standards and Reagents (continued)				
Are standard solutions, reagents, and solvents appropriately labeled?	X			
Are records retained for the source of standard solutions, solvents, reagents, etc.?	X			
Are records available for the source and purity of solvents, reagents, etc.?	X			
Are standards or reference materials discarded after the recommended shelf life has expired?	X			constantly checked, discarded after con. if results vary by too much

APPENDIX M

SAMPLING AND ANALYSIS PROCEDURES

M.1 Sampling Procedures M-2
M.2 Calibration Protocol M-27
M.3 Radian Draft Method M-30
M.4 ASME Draft Methods M-57

M.1 Sampling Procedures

Summary of EPA Reference Methods Used During Test Program

The following sampling methods were used during the MERC test program. The EPA Reference Methods are taken from the Environmental Reporter, Vol. I - Federal Regulations, Sec. 121, "Air," Appendix A. The PCDD/PCDF sampling method was developed by a joint EPA/ASME sponsored Workshop in December 1984. The trace metals methods are draft EPA protocols. Ash sampling methods were not a standard published protocol, but were based on the most current sampling practices.

- EPA Method 1 - Sample and Velocity Traverses for Stationary Sources. This method specified the number and location of sampling points within a duct, taking into account duct size and shape and local flow disturbances.
- EPA Method 2 - Determination of Stack Gas Velocity and Volumetric Flowrate. This method specified the measurement of gas velocity and flowrate using a pitot tube, manometer, and temperature sensor. The physical dimensions of the pitot tube and its spatial relationship to the temperature sensor and any sample probe are also specified.
- EPA Method 3 - Determination of Stack Gas Molecular Weight. This method describes the extraction of a gas sample from a stack, removal of moisture by condensation, and analysis of the resulting gas sample for O_2, CO_2, and CO by means of an Orsat apparatus. The assembly and operation of the required sampling train is specified.
- EPA Method 4 - Determination of Moisture Content in Stack Gases. This method describes the extraction of a gas sample from a stack and the removal and measurement of the moisture in that sample by condensation impingers. The assembly and operation of the required sampling train is specified.
- EPA Method 5 - Determination of Particulate Emission from Stationary Sources. Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature in the range of 120 ±14°C (248 ±25°F). The particulate mass is determined gravimetrically after removal of uncombined water. During the execution of EPA Method 5, EPA Methods 1 through 4 are employed.

EPA/ASME Environmental/Standards Workshop - Sampling for the Determination of Chlorinated Organic Compounds in Stack Emissions. (December 1984 Draft). Stack gases that may contain chlorinated organic compounds are withdrawn isokinetically from the stack using a modification of the EPA Method 5 train. Basically, a sorbent module section is added after the filter and before the impingers to collect chlorinated organics. The full method used by MRI is described following.

MM5

MIDWEST RESEARCH INSTITUTE QUALITY ASSURANCE POLICY AND PROCEDURES MANUAL	Code No.: S-1
	Date: 11/20/87
	Page: 1 of 22
	Approved by: ______ Department Director
Subject: Operating Procedure - Modified Method 5 (MM5)	Approved and Released by: ______ Quality Assurance
Department: Environmental Systems Department	Revision: 1

I. Introduction

The Modified Method 5 (MM5) sampling train is one of the comprehensive sampling systems which is used to sample stack gas effluents. This system is based upon the design of units which normally are employed for sampling under EPA Method 5.

This procedure basically follows the procedures described in a draft test protocol (September 18, 1984) prepared by The American Society of Mechanical Engineers entitled, "Sampling for the Determination of Chlorinated Organic Compounds in Stack Emissions."

II. Responsibilities

A. Training

The crew chief is responsible for training all staff using this SOP. Training shall be documented in his files with a copy sent to the Quality Assurance office.

B. Enforcement

The section head is responsible for enforcing this SOP. The Quality Assurance office is responsible for verifying enforcement (via inspections) and maintaining inspection records.

III. Remedial Action

Problems with instrumentation shall be referred to the crew chief. The crew chief shall then coordinate the repair of the problem with facility personnel, or refer the problem to MRI's Instrument Services Department or the manufacturer.

IV. Principle and Applicability

A. Principle

Stack gases that may contain semivolatile organic compounds are withdrawn from the stack using a sampling train. The analyte is collected in the sampling train. The compounds of interest are determined by solvent extraction followed by gas chromatography/mass spectroscopy (GC/MS).

B. Applicability

This method is applicable for the determination of semivolatile organic compounds in stack emissions. The sampling train is so designed that only the total amount of each organic compound in the stack emissions may be determined. To date, no studies have been performed to demonstrate that the particulate and/or gaseous organic compounds collected in separate parts of the sampling train accurately describe the actual partition of each in the stack emissions. If separate parts of the sampling train are analyzed separately, the data should be included and so noted as in Section V below. The sampling shall be conducted by competent personnel experienced with this test procedure and cognizant of intricacies of the operation of the prescribed sampling train and constraints of the analytical techniques for chlorinated semivolatile organic compounds.

V. Reportability

Recognizing that modification of the method may be required for specific applications, the final report of a test where changes are made shall include: (1) the exact modification; (2) the rationale for the modification; and (3) an estimate of the effect the modification will produce on the data.

VI. Range of Minimum Detectable Stack Gas Concentration

The range of the analytical method may be expanded considerably through concentration and/or dilution. The total method sensitivity is also highly dependent on the volume of stack gas sampled and the detection limit of the analytical finish. The user shall determine for their system the minimum detectable stack gas concentration for the chlorinated organic compounds of interest. The minimum detectable stack gas concentration should generally be in the nanograms per cubic meter (ng/m^3) or lower range.

VII. Interferences

Organic compounds other than the compounds of interest may interfere with the analysis. Appropriate sample cleanup steps shall be performed. Through all stages of sample handling and analysis, care should be taken to avoid contact of samples and extracts with synthetic organic materials other than polytetrafluorethylene (TFE®). Adhesives should not be used to hold TFE® liners on lids, and lubricating and sealing greases must not be used on the sampling train.

VIII. Precision and Accuracy

Precision and accuracy measurements have not yet been made on PCDD and PCDF using this method. These measurements are needed. However, recovery efficiencies for source samples spiked with compounds have ranged from 70 to 120%.

IX. Sampling Runs, Time, and Volume

A. Sampling Runs

The number of sampling runs must be sufficient to provide minimal statistical data and in no case shall be less than three (3).

B. Sampling Time*

The sampling time must be of sufficient length to provide coverage of the average operating conditions of the source. However, this shall not be less than 2 hr.

C. Sample Volume**

The sampling volume must be sufficient to provide the required amount of analyte to meet both the minimum detection level (MDL) of the analytical finish and the allowable stack emissions. It may be calculated using the following formula:

$$\text{Sample Volume} = A \times \frac{100}{B} \times \frac{100}{C} \times \frac{1}{D}$$

where: A = the analytical MDL in ng;
B = percent (%) of the sample required per analytical finish run;
C = the sample recovery (%); and
D = the allowable stack emissions (ng/m^3).

Example: A = 0.050 ng; B = 10%; C = 50%; and D = 1 ng/m^3

$$SV = 0.05 \times \frac{100}{10} \times \frac{100}{50} \times \frac{1}{1} = 1\ \text{m}^3$$

---

* 2- or 3-hr tests.

** 60 to 100 ft^3.

X. Apparatus

A. Sampling Train

The train consists of nozzle, probe, heated particulate filter, water jacketed coiled condenser and XAD resin cartridge followed by three to five impingers (Figure 1). Provision is made for the addition of a cyclone in the heated filter box when testing sources emitting high concentrations of particulate matter, a large 2-L impinger for stacks with high moisture content, and addition of absorbing solutions in the impingers for collection of other volatile samples (i.e., HCl, metals). Descriptions of the sampling train components are contained in the following sections.

1. Nozzle*

The nozzle shall be made to the specifications of EPA Method 5. The nozzle may be made of nickel-plated stainless steel, nickel, quartz, borosilicate glass, or stainless steel.

2. Probe**

The probe shall be lined with TFE®, borosilicate, or quartz glass. A temperature-controlled jacket provides protection of the liner. The liner temperature will be maintained at 120 ± 14°C (248 ± 25°F) during the test. The liner or probe shall be equipped with connecting fittings that are capable of forming a leak-free, vacuum-tight connection without sealing greases.

3. Sample Transfer Lines (optional)***

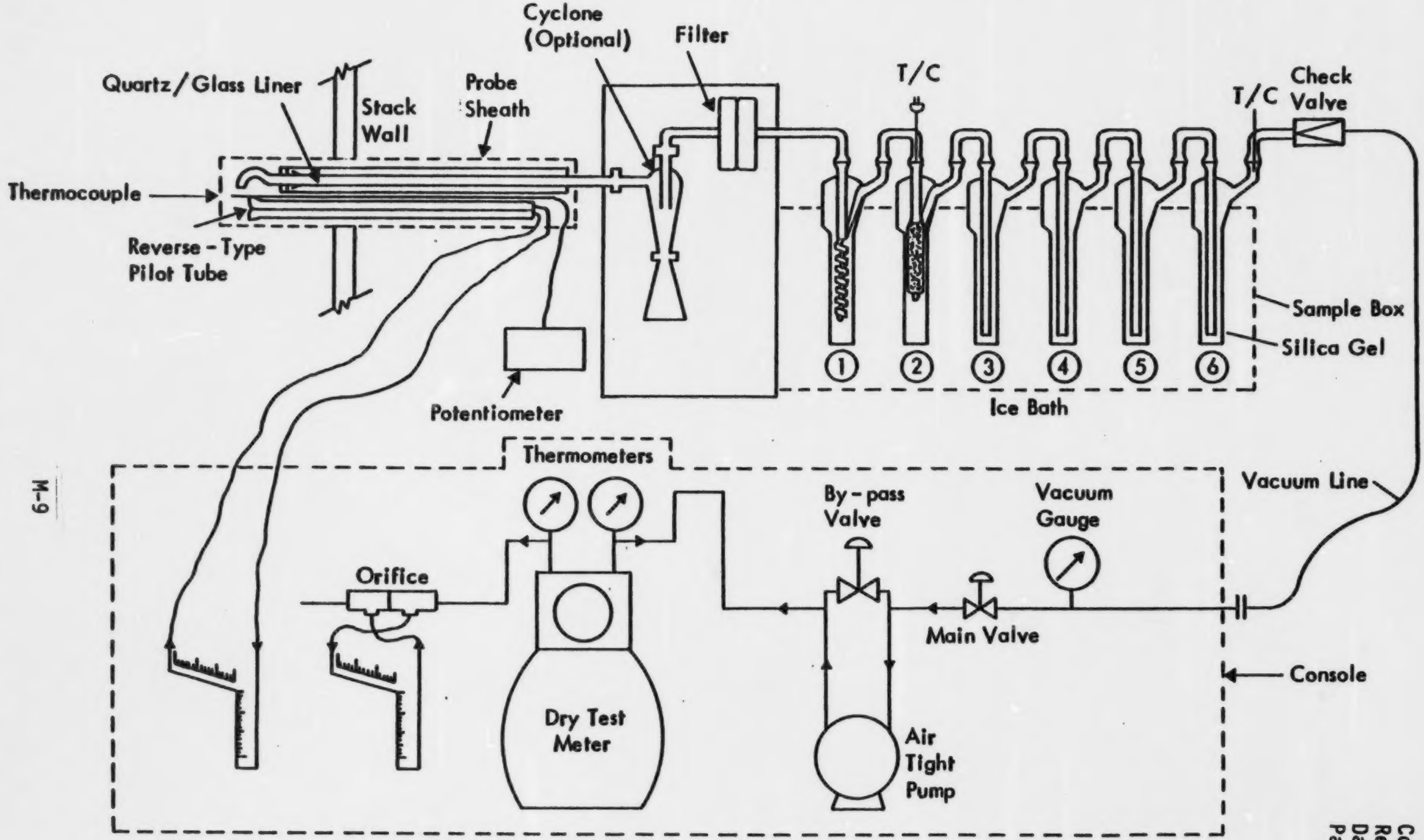
The sample transfer lines, if needed, shall be heat traced, heavy walled TFE® (1.3 cm [1/2 in.] OD x 0.3 cm [1/8 in.] wall) with connecting fittings that are capable of forming leak-free, vacuum-tight connections without using sealing greases. The line should be as short as possible and must be maintained at 120 ± 10°C.

4. Filter Holder

A stainless steel screen coated with TFE® will be used to support the filter. The holder design shall provide a positive seal against leakage from the outside or around the filter. The holder shall be attached immediately at the outlet of the probe (or cyclone, if used).

---

* A nickel nozzle will be used.
** The liner will be from borosilicate glass.
*** No transfer line.



① Condenser with Ice Water Jacket
② XAD Resin Cartridge with Ice Water Jacket
③ Modified Greenburg-Smith, 100mL of Double Distilled in Glass H_2O
④ Modified Greenburg-Smith, 100mL of Double Distilled in Glass H_2O
⑤ Modified Greenburg-Smith, Empty
⑥ Modified Greenburg-Smith, SiO_2

Figure 1. Modified Method 5 Sampling Train for Semivolatile Organic Compounds.

5. Cyclone in Filter Box (optional)*

The cyclone shall be constructed of borosilicate glass with connecting fittings that are capable of forming leak-free, vacuum-tight connections without using sealing greases.

6. Filter Heating System

The heating system must be capable of maintaining a temperature around the filter holder (and cyclone, if used) during sampling of 120 ± 14°C (248 ± 25°F). A temperature gauge capable of measuring temperature to within 3°C (5.4°F) shall be installed so that the temperature around the filter holder can be regulated and monitored during sampling.

7. Condenser and Sorbent Modules

The condenser and sorbent modules shall be made of glass with threaded Teflon to glass seals that are able to form leak-free, vacuum-tight seals without the use of sealant greases (Figure 2). The condenser and XAD-2 must be in a vertical position during sampling. The coiled condenser and XAD-2 are both jacketed with circulating cold water. A thermocouple is placed in the inlet of the XAD-2 cartridge to insure that the gas entering the XAD-2 is maintained at ≤ 20°C (68°F). The sorbent bed must be firmly packed and secured in place to prevent settling or channeling during sample collection. Glass plugs (or equivalent) must be provided to seal the sorbent-filled trap both prior to and following sampling.

8. Impingers**

Impingers are of the standard Greenburg-Smith (SGS) or modified Greenburg-Smith (MGS) design. The MGS is made by replacing the standard tip with a 1.3-cm (1/2-in.) ID glass tube extending to 1.3 cm (1/2 in.) from the bottom of the flask. The flask is a 500-mL bottle or a 2-L bottle for high moisture stacks where large volumes of moisture will be collected. Depending on the sampling need, several different impinger sequences can be used.

9. Metering System

The metering system shall consist of a vacuum gauge, a leak-free pump, thermometers capable of measuring temperature to within 3°C (~ 5°F), a dry gas meter with 2% accuracy at the required sampling rate, and related equipment, or equivalent.

---

* No cyclone.

** The following sequence of impingers will be used:
Impinger No. 1 - MGS/500 mL
Impinger No. 2 - MGS/500 mL
Impinger No. 3 - MGS/500 mL
Impinger No. 4 - MGS/500 mL

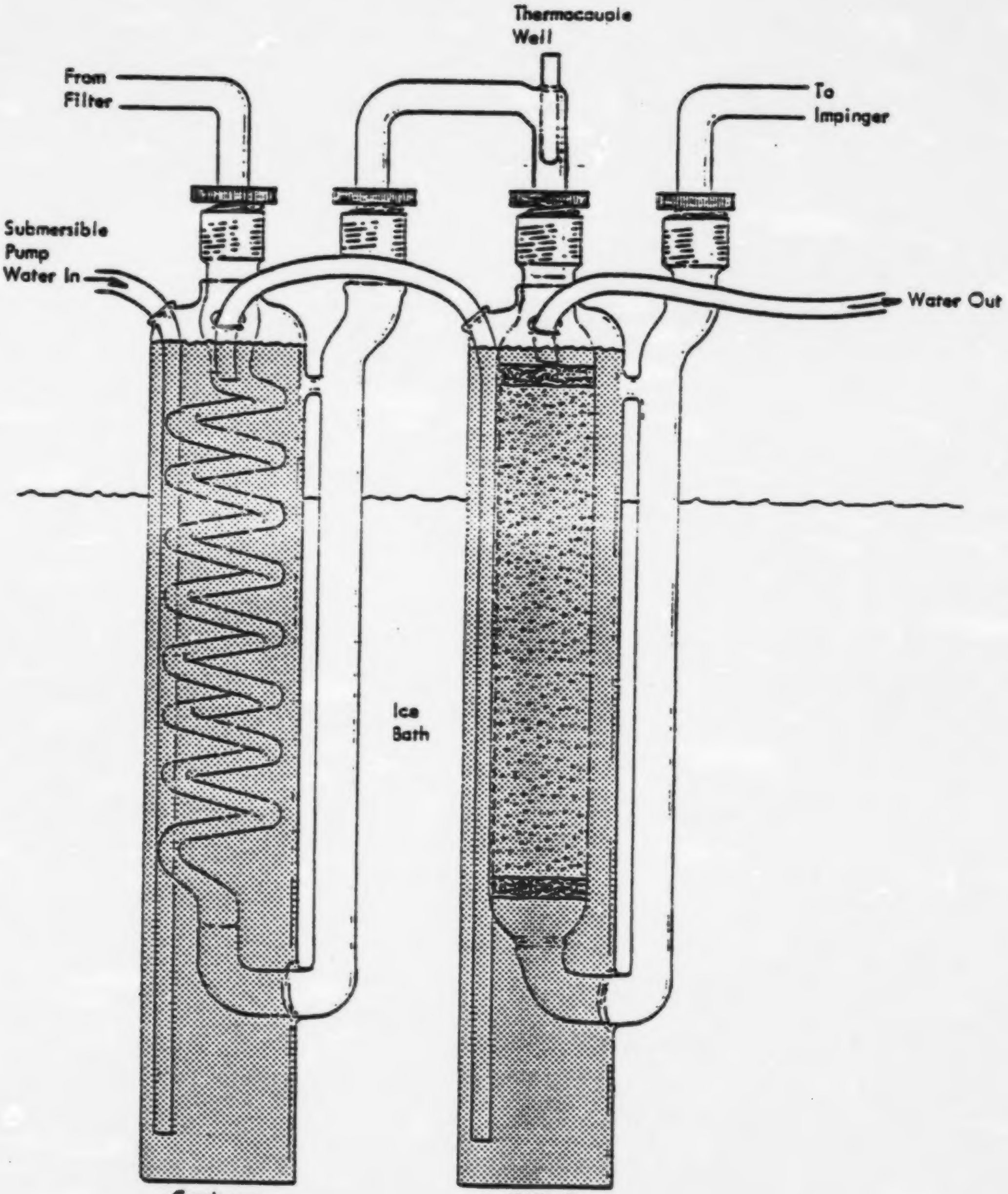


Figure 2 - MM5 Condenser and XAD Resin Cartridge

10. Barometer

Mercury, aneroid, or other barometers capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) shall be used.

B. Sample Recovery, Supplies, and Equipment

1. Glass Plugs or Hexane-Rinsed Aluminum Foil

To cap off adsorbent tube and the other sample-exposed portions of the train. If TFE® screw connections are used, then glass plugs shall be used.

2. Teflon FEP® Wash Bottle

Three 500-mL, Nalgene No. 0023A59, or equivalent.

3. Probe and Transfer Line Brush

Inert bristle brush with stainless steel rod-handle of sufficient length that is compatible with the liner or probe and transfer line.

4. Filter Storage Containers

Sealed filter holder or precleaned, wide-mouth amber glass containers with TFE®-lined screw caps or wrapped in hexane-rinsed aluminum foil.

5. Balance

Triple beam, Ohaus Model 7505, or equivalent.

6. Aluminum Foil

Heavy duty, hexane-rinsed.

7. Precleaned Metal Can

To recover used silica gel.

8. Precleaned Graduated Cylinder, e.g., 250 mL

250 mL, with 2-mL graduations, borosilicate glass.

9. Liquid Sample Storage Containers

Precleaned amber glass bottles or clear glass bottles wrapped in opaque material.

XI. Reagents

A. Sampling

1. Filter--Fiberglass Reeve-Angel 934 AH or Equivalent

Prior to use in the field, each lot of filters shall be subjected to a quality control (QC) contamination check to confirm that there are no contaminants present that will interfere with the analysis of analyte at the target detection limits. A representative sample of filters from each lot will be screened.

As a QC check, the extracting solvent(s) shall be subjected to the same concentration, cleanup, and analysis procedures to be used for the field samples.

The quantitative criterion for acceptable filter quality will depend on the detection limit criteria established for the field sampling and analysis program. Filters that give a background or blank signal per filter greater than or equal to the target detection limit for the analyte(s) of concern shall be rejected for field use. Note that acceptance criteria for filter cleanliness depends not only on the inherent detection limit of the analysis method but also on the expected field sample volume and on the desired limit of detection in the sampled stream.

If the filters do not pass the QC check, they will not be used in the test.

2. Amberlite XAD-2® Resin

The XAD-2 resin is prepared by the MRI Environmental Chemistry Section. [Cleanup procedures for the resin are presented in Section 2 of the Analytical Operating Procedures.]

3. Glass Wool

Cleaned by thorough rinsing, i.e., sequential immersion in three aliquots of hexane, dried in a 110°C oven, and stored in a hexane-washed glass jar with TFE®-lined screw caps.

4. Water

Deionized, then glass-distilled, and stored in hexane-rinsed glass containers with TFE®-lined screw caps.

5. Silica Gel

Indicating type, 6-16 mesh. If previously used, dry at 175 ± 5°C for 2 hr. New silica gel may be used as received.

6. Crushed Ice

Place crushed ice in the water bath around the impingers during sampling.

XII. Sample Recovery Reagents

A. Acetone

Pesticide quality, Burdick and Jackson "Distilled in Glass" or equivalent, stored in original containers.

B. Hexane

Pesticide quality, Burdick and Jackson "Distilled in Glass" or equivalent, stored in original containers.

XIII. Procedure

Caution: Sections XIII.A.1.b and XIII.A.1.c shall be done in the laboratory.

A. Sampling

1. Pretest Preparation

All train components shall be maintained and calibrated according to the procedures described in "The Quality Assurance Handbook for Air Pollution Measurement Systems," EPA 600/4-77-0276.

The silica gel will be weighed directly in its impinger or sampling holder just prior to train assembly. As an alternative, weigh several 200- to 300-g portions of silica gel in airtight containers to the nearest 0.5 g. Record the total weight of the silica gel plus container, on each container.

Check filters visually against light for irregularities and flaws or pinhole leaks. Pack the filters flat in a precleaned glass container.

a. Preliminary Determinations

Select the sampling site and the minimum number of sampling points according to EPA Method 1 (EPA Methods 1-4 are found in 40 CFR 60, Appendix A). Determine the stack pressure, temperature, and the range of velocity heads using EPA Method 2; perform a leak-check of the pitot lines (see EPA Method 2, Sec. 3.1). Determine the moisture content using EPA Method 4 or estimate the moisture content using prior data for the purpose of making isokinetic sampling rate-settings. Determine the stack gas dry molecular weight, as described in EPA Method 3.

Select a nozzle size based on the range of velocity heads, such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of EPA Method 2).

Select a suitable probe length such that all traverse points can be sampled. For large stacks, consider sampling from opposite sides of the stack to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time of 2 hr such that (1) the sampling time per point is not less than 2 min, and (2) the sample volume taken (corrected to standard conditions) will exceed the required minimum total gas sample volume determined in Section IX.C. The latter is based on an approximate average sampling rate.

It is recommended that the number of minutes sampled at each point be an integer or an integer plus one-half minute, in order to avoid time-keeping errors.

b. Cleaning Glasware

All glass parts of the train including the sorbent tube will be cleaned in MRI's laboratory prior to use as follows:

1. Scrub and soak in hot "Alconox" soapy water,
2. Hot water rinse,
3. Distilled water rinse,
4. Acetone rinse,
5. Methylene chloride rinse,
6. Hexane rinse,
7. Bake in 100° oven for 4 hr,
8. Cap ends in hexane rinsed aluminum foil (dull side in), and
9. Store.

c. Amberlite XAD-2® Resin Trap

Use a sufficient amount (at least 30 g or 5 g/m^3 of stack gas to be sampled) of cleaned XAD-2 to fill completely the glass sorbent trap which has been thoroughly cleaned as prescribed and rinsed with hexane. Follow the XAD-2 with hexane-rinsed glass wool and seal both ends. These seals should not be removed until the trap is fitted into the train. During storage protect the resin in the trap from light, and before placing the trap in the train wrap it with aluminum foil.

2. Preparation of Collection Train

During preparation and assembly of the sampling train, keep all train openings where contamination can enter sealed with hexane rinsed aluminum foil or glass plugs until just prior to assembly or until sampling is about to begin. Caution: Do not use sealant greases in assembling the train.

Depending on the sampling requirements,* water or absorbing solutions can be added to the impingers. Use a glass graduated cylinder to add the solutions. Place approximately 200 to 300 g or more of silica gel in the last impinger. Weigh each impinger (stem included) and record the weights on the impingers and on the data sheet.

Assemble the train as shown in Figure 1.

Place crushed ice in the water bath around the impingers.

3. Leak Check Procedures

a. Initial Leak Check

The train, including the probe, will be leak checked prior to being inserted into the stack after the sampling train has been assembled. Turn on and set (if applicable) the heating/cooling system(s) to cool the sample gas yet remain at a temperature sufficient to avoid condensation in the probe and connecting line to the first impinger (approximately 120°C). Allow time for the temperature to stabilize. Leak check the train at the sampling site by plugging the nozzle with a TFE® plug and pulling a 380 mm Hg (15 in. Hg) vacuum. A leakage rate in excess of 4% of the average sampling rate or 0.00057 m^3/min (0.02 cfm), whichever is less, is unacceptable.

The following leak check instruction for the sampling train may be helpful. Start the pump with bypass valve fully open and coarse adjust valve completely closed. Partially open the coarse adjust valve and slowly close the bypass valve until 380 mm Hg (15 in. Hg) vacuum is reached. Do not reverse the direction of the bypass valve. This will cause water to back up into the probe. If 380 mm Hg (15 in. Hg) is exceeded during the test, either leak check at this higher vacuum or end the leak check as described below and start the test over.

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* Below are the solutions and volumes for each impinger:
Impinger No. 1 - distilled in glass H_2O/100 mL
Impinger No. 2 - distilled in glass H_2O/100 mL
Impinger No. 3 - dry
Impinger No. 4 - ~ 200 g silica gel

When the leak check is completed, first slowly remove the TFE® plug from the inlet to the probe, then immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the probe.

b. Leak Checks During a Test

A leak check shall be performed before and after a change of port during a test. A leak check shall be performed before and after a component (e.g., filter or optional water knockout trap) is changed during a test.

Such leak checks shall be performed according to the procedure given in Section XIII.A.3.a of this method except that it shall be performed at a vacuum equal to or greater than the highest value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 ft^3/min) or 4% of the average sampling rate (whichever is smaller), the results are acceptable. If, however, a higher leakage rate is osberved, the tester shall either: (1) record the leakage rate and then correct the volume of gas sampled since the last leak check as shown in Section XIII.A.3.d of this method, or (2) void the test.

c. Post-Test Leak Check

A leak check is mandatory at the end of a test. This leak check shall be performed in accordance with the procedure given in Section XIII.A.3.a except that it shall be conducted at a vacuum equal to or greater than the highest value recorded during the test. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 ft^3min) or 4% of the average sampling rate (whichever is smaller), the results are acceptable. If, however, a higher leakage rate is observed, the tester shall either: (1) record the leakage rate and correct the volume as gas sampled since the last leak check as shown in Section XIII.A.3.d of this method, or (2) void the test.

d. Correcting for Excessive Leakage Rates

The equation given in Section XIV.C of this method for calculating V_m(std), the corrected volume of gas sampled, can be used as written unless the leakage rate observed during any leak check after the start of a test exceeded L_a, the maximum acceptable leakage rate (see definitions below). If an observed leakage rate exceeds L_a, then replace V_m in the equation in Section XIV.C with the following expression:

$$[V_m - \sum_{i=1}^{n} (L_i - L_a)\theta_i - (L_p - L_a)\theta_p]$$

where:

V_m = Volume of gas sampled as measured by the dry gas meter (dscf);

L_a = Maximum acceptable leakage rate equal to 0.00057 m^3/min (0.02 ft^3min) or 4% of the average sampling rate, whichever is smaller;

L_p = Leakage rate observed during the post-test leak check, m^3/min (ft^3/min);

L_i = Leakage rate observed during the leak check performed prior to the "i th" leak check (i = 1,2,3...n), m^3/min (ft^3min);

θ_i = Sampling time interval between two successive leak checks beginning with the interval between the first and second leak checks, min; and

θ_p = Sampling time interval between the last (n th) leak check and the end of the test, min.

Substitute only for those leakages (L_i or L_p) which exceeded L_a.

e. Train Operation

During the sampling run, a sampling rate within 10% of the selected sampling rate shall be maintained. Data will be considered acceptable if readings are recorded at least every 5 min and not more than 10% of the point readings are in excess of ± 10% and the average of the point readings is within ± 10%. During the run, if it becomes necessary to change any system component in any part of the train, a leak check must be performed prior to restarting.

For each run, record the data required on the data sheets. An example is shown in Figure 3. Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment and when sampling is halted.

To begin sampling, remove the nozzle cap, verify (if applicable) that the probe and sorbent module temperature control systems are working and at temperature and that the probe is properly positioned. Position the probe at the sampling point. Immediately start the pump and adjust the flow rate.

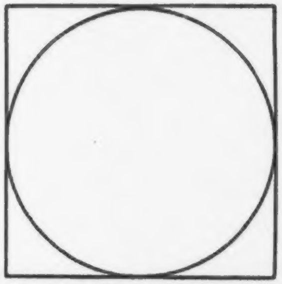
If the stack is under significant subambient pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe into the stack to avoid water backing into the probe. If necessary, the pump may be turned on with the coarse adjust valve closed.

FIELD DATA

RUN NO. ______
PROJECT NO. ______
PLANT ______
DATE ______
SAMPLING LOCATION ______
SAMPLE TYPE ______
OPERATOR ______
FILTER NO. ______
RECORD DATA EVERY ______ MIN.
UMBILICAL/SAMPLER HOOKUP ______

PROBE NO. ______
PROBE LENGTH AND TYPE ______
SAMPLE BOX NO. ______
METER BOX NO. ______
TEMP. CONTROLLER NO. ______
TEMP. METER NO. ______
THERMOCOUPLE I.D. NO. ______
UMBILICAL CORD I.D. NO. ______
UMBILICAL CORD I.D. NO. ______
NOZZLE NO. ______

NOZZLE DIA. ______
ASSUMED MOISTURE % ______
METER ΔH@ ______
METER CORRECTION ______
PITOT NO. ______
PITOT COEFFICIENT ______
BAROMETRIC PRESSURE ______
SITE TO BARO. ELEVATION (ft.) ______
CORRECTED B.P. (0.1 in./100 ft.) ______
STATIC PRESSURE ______



SCHEMATIC OF TRAVERSE POINT LAYOUT

PITOT LEAK CHECK ≥ 3" H$_2$O

	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL
TIME (24 hr)						
PASS/FAIL						

PITOT LEAK CHECK ≥ 3" H$_2$O

	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL
TIME (24 hr)						
PASS/FAIL						

SAMPLE TRAIN LEAK CHECKS

	INITIAL	FINAL	INITIAL	FINAL	INITIAL
TIME (24 hr)					
VACUUM, In. Hg	≥15"		≥15"		≥15"
CFM					
VOLUMES					
FINAL					
INITIAL					
DIFFERENCE					

SAMPLE TRAIN LEAK CHECKS

	FINAL	INITIAL	FINAL	INITIAL	FINAL
TIME (24 hr)					
VACUUM, In. Hg		≥15"		≥15"	
CFM					
VOLUMES					
FINAL					
INITIAL					
DIFFERENCE					

INITIAL VOLUME ______
FINAL VOLUME ______
LEAK CHECK VOLUME ______
ADJUSTED FINAL VOLUME ______

Figure 3 - Data Sheet

RUN NO. ______________
DATE ______________

SAMPLING LOCATION ______________
PROJECT NO. ______________

p. ________ of ________
OPERATOR ______________

TRAVERSE POINT NUMBER	CLOCK TIME (24-hr.) / SAMPLING TIME, min	GAS METER READING (V_m), ft³ INITIAL ________		VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in H_2O		STACK TEMP. (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VAC., in. Hg	IMPINGER TEMP., °F	SAMPLE BOX TEMP., °F	PROBE TEMP., °F	FILTER TEMP., °F		
		DESIRED	ACTUAL		DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F							

COMMENTS

Figure 3 - Concluded

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During the test run, make periodic adjustments to keep the probe temperature at the proper value. Add more ice and, if necessary, salt to the ice bath. Also, periodically check the level and zero of the manometer and maintain the temperature of sorbent module at or less than 20°C but above 0°C.

If the pressure drop across the train becomes high enough to make the sampling rate difficult to maintain, the test run shall be terminated unless the replacing of the filter and/or resin module corrects the problem. If the filter is replaced, a leak check shall be performed.

At the end of the sample run, turn off the pump, remove the probe and nozzle from the stack, and record the final dry gas meter reading. Perform the post test leak check.*

B. Sample Recovery

Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period.

When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe. Remove the probe from the train and close off both ends with hexane-rinsed aluminum foil. Seal off the inlet to the train with a glass plug or hexane-rinsed aluminum foil.

Transfer the probe and impinger assembly to the cleanup area. This area should be clean and enclosed so that the chances of contaminating or losing the sample will be minimized. No smoking shall be allowed.

Inspect the train prior to and during disassembly and note any abnormal conditions, e.g., broken filters, color of the impinger liquid, etc. Treat the samples as follows.

1. Container No. 1

Remove the filter from the filter holder and place it in its identified container. Use a pair of precleaned tweezers to handle the filter. If it is necessary to fold the filter, do so such that the particulate cake is inside the fold. Carefully transfer to the container any particulate matter and/or filter fibers which adhere to the filter holder gasket, by using a dry inert bristle brush and/or a sharp-edged blade. Seal the container.

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* With acceptability of the test run to be based on the same criterion as in Section XIII.A.3.a.

2. Sample Container No. 2

   Transfer the condensate from the condenser into the XAD-2®. Then transfer the condensate from the XAD module into impinger No. 1 (condensate impinger). Weigh the XAD in its original module and record the weight on the data sheet for moisture determination.

3. Cyclone Catch

   If the optional cyclone is used, quantitatively recover the particulate into a sample container and cap.

4. Sample Container No. 3

   Quantitatively recovery material deposited in the nozzle, probe, transfer line, the front half of the filter holder, and the cyclone, if used, first by brushing and then by sequentially rinsing with acetone and then hexane three times each, and add all these rinses to Container No. 3. Mark the level of liquid on container.

5. Sample Container No. 4

   Rinse the back half of the filter holder, the connecting line between the filter and the condenser, and the condenser three times each with acetone and hexane, collecting all rinses in Container No. 4.

6. Sample Container No. 5

   Remove the first and second impingers. Wipe off the outside of the impingers to remove excessive water and other material, weigh (stem included), and record the weights on a data sheet. Pour the contents and water rinses directly into Container No. 5. Record the amount of water rinse used. Remove a 25-mL aliquot and transfer it to a plastic bottle for HCl analysis. Then rinse the impingers sequentially three times with acetone and hexane and add the organic rinse to container No. 5. Mark level of liquid on container.

7. Sample Container No. 6

   Remove the third impinger, wipe the outside to remove excessive water and other debris, weigh (stem included), and record weight on data sheet. Empty the contents and rinses into Container No. 6. Rinse with distilled DI water three times. Mark level of liquid on container.

8. Silica Gel Container

   Remove the last impinger, wipe the outside to remove excessive water and other debris, weigh (stem included), and record weight on data sheet. Place the silica gel into its marked container if applicable.

If the train is to be reassembled for another run, assemble the train and place a glass plug in the cyclone bypass inlet. A check valve is located at the end of the train which prevents ambient air from entering. Do not store the train in direct sunlight or high ambient temperatures.

XIV. Calculations

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculations.

A. Nomenclature

G_s = Total weight of organic compounds in stack gas sample, μg.

C_s = Concentration of organic compounds in stack gas, μg/m^3, corrected to standard conditions of 20°C, 760 mm Hg (68°F, 29.92 in. Hg) on dry basis.

A_n = Cross-sectional area of nozzle, m^2 (ft^2).

B_{ws} = Water vapor in the gas stream, proportion by volume.

I = Percent of isokinetic sampling.

M_w = Molecular weight of water, 18 g/g-mole (18 lb/lb-mole).

P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 mm Hg-m^3/°K-g-mole (21.83 in. Hg-ft^3/°R-lb-mole).

T_m = Absolute average dry gas meter temperature °K (°R).

T_s = Absolute average stack gas temperature °K (°R).

T_{std} = Standard absolute temperature, 293°K (68°F).

m_{lc} = Total mass of liquid collected in impingers and silica gel.

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_m(std)$ = Volume of gas sample measured by the dry gas meter corrected to standard conditions, dscm (dscf).

$V_w(std)$ = Volume of water vapor in the gas sample corrected to standard conditions, scm (scf).

V_s = Stack gas velocity, calculated by combustion calculation, m/sec (ft/sec).

Y = Meter box correction factor.

ΔH = Average pressure differential across the orifice meter, mm H_2O (in. H_2O).

P_w = Density of water, 1 g/mL (0.00220 lb/mL).

θ = Total sampling time, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

B. Average Dry Gas Meter Temperature and Average Orifice Pressure Drop

See data sheet (Figure 3).

C. Dry Gas Volume

Correct the sample volume measured by the dry gas meter to standard conditions [20°C, 760 mm Hg (68 ± °F, 29.92 in. Hg)] by using Equation 1.

$$V_m(\text{std}) = Y\,V_m\,\frac{T_{std}}{T_m}\,\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}} = K_1 V_m\,Y\,\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \qquad (1)$$

where:

K_1 = 0.3855 °K/mm Hg for metric units
= 17.65 °R/in. Hg for English units.

D. Volume of Water Vapor

$$V_w(\text{std}) = m_{1c}\,\frac{RT_{std}}{M_w \times P_{std}} = K_2 m_{1c} \qquad (2)$$

where:

K_2 = 0.00134 m^3/mL for metric units
= 0.0472 ft^3/mL for English units.

E. Moisture Content

$$B_{ws} = \frac{V_{w(std)}}{V_{m}(std) + V_{w(std)}} \qquad (3)$$

If liquid droplets are present in the gas stream, assume the stream to be saturated and use a psychrometric chart to obtain an approximation of the moisture percentage.

F. Percent Isokinetic Sampling

$$I = \frac{100\ T_s\ [K_4\ M_{lc} + (Vm\ \frac{Y}{Tm})\ (P_{bar} + \Delta H/13.6)]}{60\ \theta_{V_s}\ P_s\ A_n} \qquad (4)$$

where:

K_4 = 0.003454 mm Hg - m³/mL - °K for metric units
= 0.002669 in. Hg - ft³/mL - °R for English units.

G. Concentration of Organic Compounds in Stack Gas

Determine the concentration of organic compound in the stack gas according to Equation 5.

$$C_s = K_5 \frac{G_s}{V_m\ (std)} \qquad (5)$$

where: $K_5 = 35.31\ ft^3/m^3$ if V_m is ft^3; if V_{mstd} is m^3 then $K_5 = 1$.

XV. Quality Assurance (QA) Procedures

The positive identification and quantification of specific compounds in this asessment of stationary conventional combustion sources is highly dependent on the integrity of the samples received and the precision and accuracy of all analytical procedures employed. The QA procedures described in this section were designed to monitor the performance of the sampling methods and to provide information to take corrective actions if problems are observed.

A. Field Blanks*

The field blanks should be submitted as part of the samples collected at each particular testing site. These blanks should consist of materials that are used for sample collection and storage and are expected to be handled with exactly the same procedure as each sample medium.

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* Water, XAD, filter, acetone, hexane, and Na_2CO_3 blanks will be collected.

B. Blank Train

For each series of test runs, set up a blank train in a manner identical to that described above, but with the probe inlet capped with hexane-rinsed aluminum foil. Allow the train to remain assembled for a period equivalent to one test run. The probe and filter should be heated during this time. Recover the blank sample as described in Section X.B.

M.2 Calibration Protocol

Calibration of Dry Gas Meter

Reference - Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III. EPA-600/4-77-027b, Section 3.4.2.

This method calibrates the dry gas meter through use of a wet testing meter. Accuracy is generally within ±1 percent.

Calibration of Thermometers

Reference - Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III. EPA-600/4-77-027b, Section 3.4.2.

This method is used for calibrating test thermometers by comparison to a mercury-in-glass reference thermometer under specified temperature conditions.

Calibration of Stack Gas Thermocouple

Reference - Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III. EPA-600/4-77-027b, Section 3.4.2.

This procedure gives a 3-point calibration method for the stack gas thermocouple. A mercury-in-glass thermometer is used a reference method.

Calibration of Aneroid Barometer

Reference - Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III. EPA-600/4-77-027b, Section 3.4.2.

The barometer is calibrated using a mercury-in-glass barometer or National Weather Service station as a reference.

Calibration of Sampling Probe Nozzles

Reference - Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III. EPA-600/4-77-027b, Section 3.4.2.

The nozzle diameter is determined through use of a micrometer, averaging several readings to the nearest 0.001 in.

Inspection and Calibration of Pitot Tubes

Reference - Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III. EPA-600/4-77-027b, Sections 3.1.1 and 3.1.2.

This method describes a procedure for calibration of Type S pitot tube - manometer assemblies.

Rotameter Calibration

Reference - Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III. EPA-600/4-77-027b, Sections 3.5.2.

A wet test meter is used as a reference for the calibration method.

M.3 DRAFT PROTOCOL

MULTIPLE METALS EMISSION MEASUREMENT METHOLODY

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emissions Measurement Branch
Research Triangle Park, NC 27711

METHODOLOGY FOR THE DETERMINATION OF TRACE METAL EMISSIONS IN EXHAUST GASES FROM STATIONARY SOURCE COMBUSTION PROCESSES

EMB Metals Protocol
Draft 8/1/87

METHODOLOGY FOR THE DETERMINATION OF TRACE METAL EMISSIONS IN EXHAUST GASES FROM STATIONARY SOURCE COMBUSTION PROCESSES

This document is a preliminary draft. It has not been formally released by EPA and should not at this stage be construed to represent Agency policy. It is being circulated for comment on its technical accuracy and policy implications.

EMB Metals Protocol
Draft 8/1/87

METHODOLOGY FOR THE DETERMINATION OF TRACE METAL EMISSIONS IN EXHAUST GASES FROM STATIONARY SOURCE COMBUSTION PROCESSES
(DRAFT)

1. Applicability and Principle

1.1 Applicability. This method is applicable for the determination of lead, total chromium, cadmium, arsenic, and mercury emissions from municipal waste incinerators, sewage sludge incinerators, and hazardous waste incinerators.

1.2 Principle. Particulate and gaseous metal emissions are withdrawn isokinetically from the source and collected on a heated filter, and in a series of chilled impingers containing dilute nitric acid and hydrogen peroxide, and acidic potassium permanganate solutions. An aliquot of the nitric acid/hydrogen peroxide impinger solution and an aliquot of the acidic potassium permanganate impinger solution are analyzed for mercury by cold vapor Atomic Absorption Spectroscopy (AAS). The particulate and remaining impinger catches are digested in acid solutions and analyzed for lead, total chromium, cadmium, and arsenic by Inductively Coupled Argon Plasma Spectroscopy (ICAP). Graphite furnace Atomic Absorption Spectroscopy is used for analysis of lead and arsenic if these elements are present at levels less than 2 ppm. Sampling train components are recovered and analyzed in separate front and back half fractions.

2. Range, Sensitivity, Precision, and Interferences

2.1 Range. The ICAP response is linear over several orders of magnitude. Samples containing metal concentrations in the ppb to the ppm (by weight) range can be analyzed using this technique. Samples containing greater than approximately 50 ppm of chromium, lead, or arsenic should be diluted before analysis. Samples containing greater than approximately 20 ppm of cadmium should be diluted before analysis.

This document is a preliminary draft. It has not been formally released by EPA and should not at this stage be construed to represent Agency policy. It is being circulated for comment on its technical accuracy and policy implications.

2.2 Analytical Sensitivity. ICAP detection limits for cadmium, chromium, lead, and arsenic are approximately 0.02 ppm, 0.05 ppm, 0.1 ppm, and 0.2 ppm, respectively. The detection limits for lead and arsenic for analysis by graphite furnace AAS are approximately 0.001 ppm. The detection limit for mercury by cold vapor AAS is approximately 0.5 ppb. Ideally, samples should contain at least ten times the detection limit to help provide a more accurate measurement as well as to ensure that the analytical method will be able to detect the metals of interest.

2.3 Precision. No precision data are available for this method at this time.

2.4 Interferences. Iron can be an analytical interference during the analysis of arsenic, chromium, and cadmium by ICAP. Aluminum can be an interference during the analysis of arsenic and lead by ICAP. Generally, this interference can be reduced by diluting the sample, but this increases the method detection limit. Refer to EPA Method 6010 (OSW 846) for complete details on potential interferences for this method. Matrix modifiers should be used for all graphite furnace analyses to limit interferences. In addition, all standards should be matrix matched for AAS graphite analysis.

3. Apparatus

3.1 Sampling Train. A schematic of the sampling train is shown in Figure 1. It is similar to the Method 5 train. The sampling train consists of the following components.

3.1.1 Probe Nozzle and Probe Liner. Same as Method 5, Sections 2.1.1 and 2.1.2.

3.1.2 Pitot Tube and Differential Pressure Gauge. Same as Method 2, Sections 2.1 and 2.2, respectively.

3.1.3 Filter Holder. Glass, same as Method 5, Section 2.1.5, except that a glass frit filter support is required.

3.1.4 Filter Heating System. Same as Method 5, Section 2.1.6.

3.1.5 Condenser. The following system shall be used for the condensation and collection of gaseous metals and for determining the moisture content of the stack gas. The condensing system should consist of five impingers connected in series with leak-free ground glass fittings or other leak-free, non-contaminating fittings. The first impinger should be Greenburg-Smith design modified by shortening the tip. The shortened tip should extend to a point just inside the ground glass joint. The fifth impinger should be a Greenburg-Smith design by removing the tip. The second, third, and fourth impingers should be unmodified Greenburg-Smith impingers. The first impinger should be empty, the second and third shall contain known quantities of a nitric acid/hydrogen peroxide solution (Section 4.2.1), the fourth shall contain a known quantity of acidic potassium permanganate solution (Section 4.2.2), and the fifth shall contain a known quantity of silica gel or equivalent desiccant. A thermometer, capable of measuring to within 1°C (2°F) shall be placed at the outlet of the fifth impinger.

3.1.6. Metering System, Barometer, and Gas Density Determination Equipment. Same as Method 5, Sections 2.1.8 through 2.1.10, respectively.

3.2 Sample Recovery. The following items are needed for sample recovery:

3.2.1 Nonmetallic Probe Liner and Probe Nozzle Brushes, Wash Bottles, Sample Storage Containers, Petri Dishes, Graduated Cylinders, Plastic Storage Containers, Funnel and Rubber Policeman, and Glass Funnel. Same as Method 5, Sections 2.2.1 through 2.2.8, respectively.

3.2.2 Labels. For identification of samples.

3.2.3 Polypropylene Tweezers and/or Plastic Gloves. For recovery of the filter from the sampling train filter holder.

3.2.4 Nylon Bristle Brush. For quantitative recovery of materials collected in the front half of the sampling train.

3.3 Sample Preparation and Analysis. For the analysis, the following equipment is needed:

3.3.1 Volumetric Flasks, 100 ml, 250 ml, and 1000 ml. For preparation of standards and sample dilution.

3.3.2 Graduated Cylinders. For preparation of reagents.

3.3.3 Parr^R Bombs or Microwave Pressure Relief Vessels with Capping Station (CEM Corporation model or equivalent).

3.3.4 Beakers and Watchglasses. 250 ml beakers for sample digestion with watchglasses to cover the tops.

3.3.5 Ring Stands and Clamps. For securing equipment such as filtration apparatus.

3.3.6 Filter Funnels. For holding filter paper.

3.3.7 Whatman 541 Filter Paper (or equivalent). For filtration of digested samples.

3.3.8 Disposable Pasteur Pipets and Bulbs.

3.3.9 Volumetric Pipets.

3.3.10 Analytical Balance. Accurate to within 0.1 mg.

3.3.11 Microwave or Conventional Oven. For heating samples at fixed power levels or temperatures.

3.3.12 Hot Plates.

3.3.13 Atomic Absorption Spectrometer (AAS). Equipped with a background corrector.

3.3.13.1 Graphite Furnace Attachment. With arsenic and lead hollow cathode lamps (HCLs) or electrodeless discharge lamps (EDLs). Same as EPA Method 206.2 (arsenic) and EPA Method 239.2 (lead).

3.3.13.2 Cold Vapor Mercury Attachment. With a mercury HCL or EDL. The equipment needed for the cold vapor mercury attachment includes an air recirculation pump, a quartz cell, an aerator apparatus, and a heat lamp or desiccator tube. The heat lamp should be capable of raising the ambient temperature at the quartz cell by 10^{0}C such that no condensation forms on the wall of the quartz cell. Same as EPA Method 7470.

3.3.14 Inductively Coupled Argon Plasma Spectrometer. With either a direct or sequential reader and an alumina torch. Same as EPA Method 200.7.

4. Reagents

Unless otherwise indicated, it is intended that all reagents conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available; otherwise, use the best available grade.

4.1 Sampling. The reagents used in sampling are as follows:

4.1.1 Filters. Glass fiber or quartz filters, without organic binders, with background concentrations of lead, total chromium, cadmium, arsenic, and mercury of less than 1 ppb, 50 ppb, 20 ppb, 1 ppb, and 0.5 ppb, respectively. The filters should exhibit at least 99.95 percent efficiency (<0.05 percent penetration) on 0.3 micron dioctyl phthalate smoke particles. The filter efficiency test shall be conducted in accordance with ASTM Standard Method D2986-71 (incorporated by reference). Pallflex type 2500 QAT-UP Ultra Pure Filters have been found to be acceptable.

4.1.2 Water. Deionized, distilled to conform to ASTM Specification D1193-77, Type 3 (incorporated by reference). Analyze the water for all target metals prior to field use.

4.1.3 Nitric Acid. Concentrated. Baker Instra-analyzed or equivalent.

4.1.4 Hydrogen Peroxide, 30 Percent (V/V).

4.1.5 Potassium Permanganate.

4.1.6 Sulfuric Acid. Concentrated.

4.1.7 Silica Gel and Crushed Ice. Same as Method 5, Sections 3.1.2 and 3.1.3, respectively.

4.2 Pretest Preparation for Sampling Reagents.

4.2.1 Nitric Acid/Hydrogen Peroxide Absorbing Solution. Add 50 ml of concentrated nitric acid and 333 ml of 30 percent hydrogen peroxide to a 1000 ml volumetric flask containing approximately 500 ml of deionized distilled water. Dilute to volume with water.

4.2.2 Acidic Potassium Permanganate Solution. Fill a 1 liter volumetric flask with approximately 800 ml of deionized distilled water. Weigh out 15.0 g of potassium permanganate and dissolve it in the water. Add 100 ml of concentrated sulfuric acid and mix well. Let the solution cool and dilute to volume with water.

4.2.3 Nitric Acid, 0.1 N. Add 6.3 ml of concentrated nitric acid (70 percent) to a graduated cylinder containing approximately 900 ml of deionized distilled water. Dilute to 1000 ml with water. Mix well.

4.3 Glassware Cleaning Reagents.

4.3.1 Nitric Acid, Concentrated. Fisher ACS grade or equivalent.

4.3.2 Water. Distilled, deionized to conform to ASTM Specifications D1193-77, Type 3.

4.3.3 Nitric Acid, 10 Percent (V/V). Add 500 ml of concentrated nitric acid to a graduated cylinder containing approximately 4000 ml of water. Dilute to 5000 ml with water.

4.4 Sample Digestion and Analysis Reagents.

4.4.1 Hydrofluoric Acid, Concentrated.

4.4.2 Nitric Acid. Concentrated. Baker Instra-analyzed or equivalent.

4.4.3 Nitric Acid, 10 Percent (V/V). Add 100 ml of concentrated nitric acid to 800 ml of deionized distilled water. Dilute to 1000 ml with water. Mix well.

4.4.4 Nitric Acid, 5 Percent (V/V). Add 50 ml of concentrated nitric acid to 800 ml of deionized distilled water. Dilute to 1000 ml with water.

4.4.5 Water. Distilled, deionized to conform to ASTM Specifications D1193-77, Type 3.

4.4.6 Hydroxylamine Hydrochloride.

4.4.7 Stannous Sulfate.

4.4.8 Nickel Nitrate, $Ni(NO_3)_2 \cdot 6H_2O$.

4.4.9 Lanthanum Oxide, La_2O_3.

4.4.10 AAS Grade Hg Standard, 1000 ppm.

4.4.11 AAS Grade Pb Standard, 1000 ppm.

4.4.12 AAS Grade As Standard, 1000 ppm.

4.4.13 AAS Grade Cd Standard, 1000 ppm.

4.4.14 AAS Grade Cr Standard, 1000 ppm.

4.4.15 AAS Grade Al Standard, 1000 ppm.

4.4.16 AAS Grade Fe Standard, 1000 ppm.

4.4.17 The metals standards may also be made from solid chemicals as outlined in EPA Method 200.7. EPA Method 7470 or Standard Methods for the Analysis of Water and Wastewater, 15th Edition, Method 303F should be referred to for additional information on mercury standards.

4.4.18 Mercury Standards and Quality Control Samples. Prepare a 10 ppm mercury standard by adding 1 ml of 1000 ppm mercury standard to a 100 ml volumetric flask. Dilute to 100 ml with 10 percent nitric acid.

Prepare a 100 ppb standard by adding 10 ml of the 10 ppm standard to a 100 ml volumetric flask and dilute to 100 ml with 10 percent nitric acid. Other standards should be prepared by dilution of the 100 ppb mercury standard. At least four standards should be used to prepare the standard curve. Suggested levels are 10, 50, 75, and 100 ppb. Quality control samples should be prepared by making a separate 10 ppm standard and diluting until it is in the range of the samples. Same as EPA Method 7470 or Standard Methods for the Analysis of Water and Wastewater, 15th Edition, Method 303F.

4.4.19 ICAP Standards and Quality Control Samples. Arsenic, cadmium, and lead can be combined into a single standard for the ICAP standards. Chromium, iron, and aluminum standards must be prepared in separate solutions. Prepare these standards by diluting the 1000 ppm metals solutions with 5 percent nitric acid. A minimum of one standard and a blank can be used to form each calibration curve. However, a separate quality control sample spiked with known amounts of the target metals in quantities expected to be in the midrange of the calibration curve should be prepared. Suggested standard levels are 50 ppm for the aluminum, 25 ppm for the chromium and lead, 15 ppm for the iron, and 10 ppm for the arsenic and cadmium. Standards containing less than 1 ppm of metal should be prepared daily. Standards containing greater than 1 ppm of metal should be stable for a minimum of 1 to 2 weeks.

4.4.20 AAS Graphite Furnace Standards for Arsenic and Lead. Prepare a 10 ppm lead and arsenic standard by adding 1 ml each of 1000 ppm arsenic standard and 1000 ppm lead standard to a 100 ml volumetric flask. Dilute to 100 ml with 10 percent nitric acid. Prepare a 100 ppb standard by adding 1 ml of the 10 ppm standard to a 100 ml volumetric flask and dilute to 100 ml with 10 percent nitric acid. Other standards should be prepared by dilution of the 100 ppb arsenic and lead standard. At least four standards should be used to make up the standard curve. Suggested levels are 10, 50, 75, and 100 ppb. Quality control samples should be prepared by making a separate 10 ppm standard and diluting until it is in the range of the samples. Standards containing less than 1 ppm of metal should be prepared daily. Standards containing greater than 1 ppm of metal should be stable for a minimum of 1 to 2 weeks.

Note: For graphite furnace AAS, the standards must be matrix matched; e.g., if the samples contain 6 percent nitric acid and 4 percent hydrofluoric acid, the standards should also be made up with 6 percent nitric acid and 4 percent hydrofluoric acid.

4.4.21 Matrix Modifiers.

4.4.21.1 Nickel Nitrate, 1 Percent (V/V). Dissolve 4.956 g of $Ni(NO_3)_2 \cdot 6H_2O$ in approximately 50 ml of water in a 100 ml volumetric flask. Dilute to 100 ml with water.

4.4.21.2 Nickel Nitrate, One-tenth Percent (V/V). Dilute 10 ml of 1 percent nickel nitrate solution to 100 ml with water. Inject an equal amount of sample and this modifier into the graphite furnace during AAS analysis for As.

4.4.21.3 Lanthanum. Dissolve 0.5864 g of La_2O_3 in 10 ml of concentrated HNO_3 and dilute to 100 ml with water. Inject an equal amount of sample and this modifier into the graphite furnace during AAS analysis for Pb.

5. Procedure

5.1 Sampling. The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

5.1.1 Pretest Preparation. Follow the same general procedure given in Method 5, Section 4.1.1, except the filter need not be desiccated or weighed. All sampling train glassware should first be rinsed with hot tap water and then washed in hot soapy water. Next, glassware should be rinsed three times with tap water, followed by three additional rinses with deionized distilled water. All glassware should then by soaked in a 10 percent (V/V) nitric acid solution for a minimum of 8 hours, rinsed three times with distilled deionized water, rinsed a final time with acetone, and allowed to air dry. All glassware openings where contamination can occur should be covered until the sampling train is assembled, prior to sampling.

5.1.2 Preliminary Determinations. Same as Method 5, Section 4.1.2.

5.1.3 Preparation of Sampling Train. Follow the same general procedures given in Method 5, Section 4.1.3, except place 100 ml of the nitric acid/hydrogen peroxide solution (Section 4.2.1) in the second and third impingers, place 100 ml of the acidic potassium permanganate solution (Section 4.2.2) in the fourth impinger, and transfer approximately 200 to 300 g of preweighed silica gel from its container to the fifth impinger. The first impinger should remain empty. Retain for reagent blanks, 100 ml of the nitric acid/hydrogen peroxide solutions used for the second and third impingers and 100 ml of the acidic potassium permanganate solution used for the fourth impingers. The aliquots of impinger solutions should be placed in separate sample containers (Container Nos. 7 and 8, respectively), labeled and treated as described in Section 7. Set up the sampling train as shown in Figure 1.

5.1.4 Leak-Check Procedures. Follow the leak-check procedures given in Method 5, Section 4.1.4.1 (Pretest Leak Check), Section 4.1.4.2 (Leak-Checks During the Sample Run), and Section 4.1.4.3 (Post-Test Leak Checks).

5.1.5 Sampling Train Operation. Follow the procedures given in Method 5, Section 4.1.5. For each run, record the data required on a data sheet such as the one shown in Figure 5-2 of Method 5.

5.1.6 Calculation of Percent Isokinetic. Same as Method 5, Section 4.1.6.

5.2 Sample Recovery. Begin cleanup procedures as soon as the probe is removed from the stack at the end of a sampling period.

The probe should be allowed to cool prior to sample recovery. When it can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a rinsed cap over the probe nozzle to prevent losing or gaining particulate matter. Do not cap the probe tip tightly while the sampling train is cooling. This would cause a vacuum to form in the filter holder, thus drawing liquid from the impingers into the filter.

Before moving the sampling train to the cleanup site, remove the probe from the sampling train and cap the open outlet. Be careful not to lose any condensate that might be present. Cap the filter inlet where the probe was fastened. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the first impinger and the filter holder, disconnect the line at the filter holder and let any condensed liquid drain into the first impinger. Cap off the filter holder outlet and impinger inlet. Use either ground-glass stoppers, plastic caps, or serum caps to close these openings.

Transfer the probe and filter-impinger assembly to a cleanup area that is clean and protected from the wind to minimize the chance of contamination or loss of sample. Inspect the train before and during disassembly and note any abnormal conditions. Treat the sample as follows:

5.2.1 Container No. 1 (Filter). Carefully remove the filter from the filter holder and place it in its identified petri dish container. Acid-washed polypropylene tweezers or clean, disposable surgical gloves rinsed with distilled, deionized water should be used to handle the filters. If it is necessary to fold the filter, fold the filter so that the particulate cake is inside the fold. Carefully transfer to the petri dish any particulate matter and/or filter fibers that adhere to the filter holder gasket by using a dry (acid-cleaned) nylon bristle brush. Do not use any metal-containing materials when recovering this train. Seal the labeled petri dish.

5.2.2 Container No. 2 (Probe). Taking care that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe liner, probe nozzle, and front half of the filter holder by rinsing these components thoroughly with 0.1 N nitric acid and placing the wash into a sample storage container. Perform the rinses as described in Method 12, Section 5.2.2. Measure and record the volume of the combined rinses, and place the sample into a storage container. Mark the height of the fluid level on the outside of the container and clearly label the contents.

5.2.3 Container No. 3 (Impingers 1 through 3, Contents and Rinses). Due to the large quantity of liquid involved, the tester may place the impinger solutions in several containers. Measure the liquid in the first three impingers to within 1 ml using a graduated cylinder. Record the volume of liquid present. This information is required to calculate the moisture content of the sampled flue gas. Clean each of the first three impingers and connecting glassware by thoroughly rinsing with 0.1 N nitric acid as described in Method 12, Section 5.2.4. Combine the rinses and impinger solutions, measure and record the volume, and place in a labeled storage container. The height of the fluid level should be marked to determine if leakage occurs during transport.

5.2.4 Container No. 4 (Acidified Potassium Permanganate Solution and Rinses, Impinger No. 4). Pour all the liquid from the fourth impinger into a graduated cylinder and measure the volume to within 1 ml. This information is required to calculate the moisture content of the sampled flue gas. Rinse the fourth impinger and its connecting glass pieces a minimum of three times with acidified potassium permanganate solution. Combine the rinses with the impinger solution in a graduated cylinder and measure the total volume. Place the combined rinses and impinger contents in a labeled container. Mark the height of the fluid level on the bottle to determine if leakage occurs during transport. Seal and label the container.

Note: Due to the reaction of the potassium permanganate with the acid, there may be pressure buildup in the sample storage bottles. These bottles should not be filled full and should be vented to relieve excess pressure.

5.2.5 Container No. 5 (Silica Gel). Note the color of the indicating silica gel to determine whether it has been completely spent and make a notation of its condition. Transfer the silica gel from its impinger to its original container and seal. The tester may use a funnel to pour the silica gel and a rubber policeman to remove the silica gel from the impinger. The small amount of particles that may adhere to the impinger wall need not be removed. Do not use water or other liquids to transfer the silica gel since weight gained in the silica gel impinger is used for moisture calculations. Alternatively, if a balance is available in the field, record the weight of the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g.

5.2.6 Container No. 6 (0.1 N Nitric Acid Blank). Place 100 ml of the 0.1 N nitric acid solution used in the sample recovery process into a labeled container for use as a recovery solvent blank. Seal the container.

5.2.7 Container No. 7 (Acidified Potassium Permanganate Blank). Place 100 ml of the acidified potassium permanganate solution used as the impinger solution and in the sample recovery process into a labeled container for use as a blank. Seal the container.

5.3 Sample Preparation. Note the level of the liquid in each of the containers and determine if any sample was lost during shipment. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. A diagram illustrating sample preparation and analysis procedures for each of the sample train components is shown in Figure 2.

5.3.1 Container No. 1 (Filter). The filter should be shredded and divided into portions approximately 0.5 g each. Each of the shredded filter portions should be placed into an individual microwave pressure relief vessel or Parr^R Bomb. Six ml of concentrated nitric acid and 4 ml of concentrated hydrofluoric acid should be added to each vessel. The microwave vessels should be tightened and microwaved for approximately 9 minutes in intervals of 1 to 2 minutes at 600 Watts. The Parr^R Bombs should be heated at 140°C (285°F) for 6 hours. The samples should be cooled and combined with the acid digested probe rinses (Container 2). This combined sample is referred to as Fraction 1.

Note: If the sampling train uses and optional cyclone, the cyclone catch should be prepared and digested using the same procedures described for the filters. The digested cyclone catch should be combined with the digested filter samples.

5.3.2 Container No. 2 (Probe). Check the pH of this sample. The sample should be acidified with nitric acid to approximately pH 2. The sample should be rinsed into a beaker with distilled deionized water and the beaker should be covered with a ribbed watchglass. The sample volume should be reduced to approximately 20 ml by heating on a hot plate at a temperature just below boiling. Put the sample into a microwave pressure relief vessel or a Parr^R Bomb. Six ml of concentrated nitric acid and 4 ml of concentrated hydrofluoric acid should be added to each vessel. The microwave vessels should be tightened and microwaved for approximately 9 minutes in intervals of 1 to 2 minutes at 600 Watts. The Parr^R Bombs should be heated at 140°C (285°F) for 6 hours. The samples should be cooled and combined with the acid digested portion of the filter. Filter the combined solution of the acid digested filter and probe rinse samples. Dilute to a known volume with water. The final volume should be chosen to yield a matrix of approximately 6 percent nitric acid and 4 percent hydrofluoric acid. Measure and record the final volume of the sample solution.

5.3.3 Container No. 3 (Impingers 1-3). Measure and record the total volume of this sample. Reserve a 50 ml aliquot for mercury analysis. The remaining portion of Container No. 3 should be acidified with nitric acid to approximately pH 2. The sample should be rinsed into a beaker with distilled deionized water and the beaker should be covered with a ribbed watchglass. The sample volume should be reduced to approximately 20 ml by heating on a hot plate at a temperature just below boiling. Then follow either of the digestion procedures described in Sections 5.3.3.1 and 5.3.3.2.

5.3.3.1 Conventional Digestion Procedure. Add 30 ml of 50 percent nitric acid and heat for 30 minutes on a hot plate to just below boiling. Add 10 ml of 3 percent hydrogen peroxide and heat for 10 more minutes. Add 50 ml of hot, deionized water and heat the sample for an additional 20 minutes. Cool, filter the sample, and dilute to 100 ml (or the appropriate volume for the expected metals concentrations) with distilled deionized water.

5.3.3.2 Microwave Digestion Procedure. Add 10 ml of 50 percent nitric acid and heat for 6 minutes in intervals of 1 to 2 minutes. Add 10 ml of 3 percent hydrogen peroxide and heat for 2 more minutes. Add 50 ml of hot, deionized water and heat for an additional 5 minutes. Cool, filter the sample, and dilute to 100 ml (or the appropriate volume for the expected metals concentrations) with distilled, deionized water.

Note: All microwave heating times given are approximate and are dependent upon the number of samples being digested at a time.

5.3.4 Container No. 5 (Silica Gel). Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g using a balance. (This step may be conducted in the field.)

5.4 Sample Analysis. For each sampling train, four individual samples corresponding to specific train components will be generated.

The first sample (Fraction 1) contains the materials collected in the front half of the sampling train. This front half sample consists of the filter (Container No. 1, Section 5.2.1), probe and nozzle catches, and rinses of the probe liner, nozzle, and front half of the filter assembly (Container No. 2, Section 5.2.2).

The second sample (Fraction 2) contains materials collected in the back half of the sampling train (excluding Impingers 4 and 5). This back half sample consists of the impinger contents and rinses from Impingers 1 through 3 and the rinses of the back half of the filter holder assembly (Container No. 3, Section 5.2.3).

The third sample (Fraction 3) consists of a 50 ml aliquot from Container No. 3 (Impingers 1-3). This sample will be analyzed specifically for mercury.

The fourth sample (Fraction 4) consists of the impinger contents and rinses from Impinger No. 4 (Component No. 4, Section 5.2.4). The fourth impinger contains an acidic potassium permanganate solution specifically for the collection of mercury.

5.4.1 ICAP. Analysis. Both the digested filter and probe rinse sample (Fraction 1), and the digested impinger solutions and impinger rinses sample (Fraction 2) will be analyzed by ICAP using EPA Method 200.7.

Calibrate the ICAP as described in Section 7.2 of this method. Set up an analysis program as described in EPA Method 200.7. Recommended wavelengths for use in the analysis include the following: Fe, 259.94 nm; Al, 396.15 nm; As, 197.2 nm; Pb, 220.35 nm; Cd, 226.50 nm; and Cr, 205.55 nm. Initially, analyze all samples for iron, aluminum, arsenic, lead, cadmium, and chromium. If iron and aluminum are present in the sample, dilute the sample so that each of these elements is at a concentration of less than 50 ppm before analyzing for arsenic and lead. If arsenic or lead levels are less than approximately 1 to 2 ppm, graphite furnace AAS should be used for these elements.

Note: When analyzing samples in a hydrofluoric acid matrix, an alumina torch should be used. All front half samples will contain hydrofluoric acid.

5.4.2 AAS Graphite Furnace Analysis for Arsenic and Lead. For low levels (less than 1 to 2 ppm) of arsenic and lead, both the digested filter and probe rinse sample (Fraction 1) and the digested impinger absorbing solutions and impinger rinses sample (Fraction 2) should be analyzed using graphite furnace atomic absorption spectroscopy.

Set up the graphite furnace AAS for the analysis of arsenic or lead, using the proper lamp and the following recommended wavelengths; As, 193.7 nm; and Pb, 217.0 nm. Calibrate the instrument as described in Section 7.3. When the instrument is calibrated, analyze the samples. All samples values should fall on the standard curve. If they do not, the samples should be diluted so that they fall on the curve. A nickel nitrate matrix modifier should be used during all arsenic analyses and a lanthanum nitrate matrix modifier should be used during all lead analyses. Refer to EPA Methods 206.2 and 239.2 for further details on the analysis of arsenic and lead, respectively.

5.4.3 Cold Vapor Mercury Analysis. The acidic potassium permanganate solutions, Fraction 4, and the reserved portion of Fraction 3 should be analyzed for mercury using atomic absorption spectroscopy following the method outlined in EPA Method 7470 or in Standard Methods for Water and Wastewater Analysis, 15th Edition, Method 303F. Set up the calibration curve as described in Section 7.3 of Method 303F. Add from 10 to 50 ml of each sample to BOD bottles. Record the amount of sample added. The amount used is dependent upon the expected levels of mercury. Dilute to approximately 120 ml with water. Add approximately 2 ml of 5 percent potassium permanganate solution to the Fraction 3 sample (since this sample is not in a potassium permanganate matrix). Add 5 ml of 30 percent nitric acid and 5 ml of 50 percent sulfuric acid to each sample and each standard. Digest at 95°C (205°F) in a water bath for 2 hours. Add 5 ml of hydroxylamine hydrochloride and mix the sample. Then add 10 ml of stannous sulfate to each sample and analyze immediately.

6. Calibration

Maintain a laboratory log of all calibrations.

6.1 Sampling Train Calibration. Calibrate the sampling train components according to the indicated sections of Method 5: Probe Nozzle (Section 5.1); Pitot Tube (Section 5.2); Metering System (Section 5.3); Probe Heater (Section 5.4); Temperature Gauges (Section 5.5); Leak-Check of the Metering System (Section 5.6); and Barometer (Section 5.7).

6.2 Inductively Coupled Plasma Argon Spectrometer Calibration. Prepare standards as outlined in Section 4.6.4. Profile and calibrate the instrument according to the instrument manufacturer's recommended procedures using the above standards. The instrument calibration should be checked once per hour. If the instrument does not reproduce the concentrations of the standard within 10 percent, the complete calibration procedures should be performed.

6.3 Atomic Absorption Spectrometer - Graphite Furnace and Cold Vapor Mercury Analyses. Prepare the standards as outlined in Section 4.6.5. Calibrate the spectrometer using these prepared standards. [Calibration procedures are also outlined in EPA Method 7470 or in Standard Methods for Water and Wastewater, 15th Edition, Method 303F (for mercury), EPA Method 206.2 (for arsenic), and EPA Method 239.2 (for lead)]. Each standard curve should be run in duplicate and the mean values used to calculate the line. The instrument should be recalibrated approximately once every 10 to 12 samples.

7. Quality Control

7.1 Sampling. The following quality control samples should be collected during sampling:

7.1.1 Field Blank. A blank train should be set up and recovered, digested, and analyzed as outlined in Sections 5.1.2, 5.2, 5.3, and 5.4, respectively.

7.1.2 Field Reagent Blanks. A 100 ml aliquot of the 0.1 N nitric acid solution used in the sample recovery process should be poured into a labeled plastic container (Container No. 6). A 100 ml aliquot of the acidic potassium permanganate absorbing solution used in the fourth impinger should be poured into a labeled plastic container (Container No. 7). A 100 ml aliquot of the 5 percent nitric acid/10 percent hydrogen peroxide absorbing solution should be poured into a labeled plastic container (Container No. 8). A blank filter should be placed in a labeled petri dish (Container No. 9). All of these containers should be sealed.

The field reagent blanks should not be digested unless the analysis of the field blank shows a high level of contamination. If a high level of contamination is present, then each of the reagent blanks should be digested and analyzed separately as described in Sections 5.3 and 5.4 to help determine the cause of contamination.

7.2 Laboratory Blanks. A reagent blank should be made up by digesting only the reagents used in Section 5.3. This reagent blank should be analyzed following the method outlined in Section 5.4.

7.3 Method Spikes. Two method spikes should be prepared. The first method spike is prepared by spiking the metals of interest onto a blank filter and following the digestion procedure outlined in Section 5.3.1. The second method spike is prepared by spiking the metals of interest into 100 ml of Type 3 distilled deionized water and then taking this sample through the digestion process outlined in Section 5.3.2. Both these method spikes should be analyzed following the method outlined in Section 5.5.

7.4 Quality Control Samples. The following quality control samples should be analyzed.

7.4.1 ICAP Analysis. Follow the quality control requirements set up in Section 12 of Method 200.7. These requirements include the following: an instrument check standard run with a frequency of 10 percent (may be one of the standards); a calibration blank run with a frequency of 10 percent; an interferent check sample at the beginning, end, and at periodic intervals during the analysis; and a quality control sample to check the accuracy of the calibration standards. In addition, one duplicate and one standard addition should be run for each ten samples.

7.4.2 AAS Graphite Furnace Analysis for Arsenic and Lead. All samples should be analyzed in duplicate. Analyze one sample in triplicate for each ten samples. Perform a matrix spike on at least one sample out of every ten samples. If recoveries of less than 80 percent or greater than 120 percent are obtained for the matrix spike, analyze each sample by methods of addition. A quality control sample should be analyzed to check the accuracy of the calibration standards.

7.4.3 Cold Vapor Mercury Analysis. All samples should be analyzed in duplicate. A quality control sample should be analyzed to check the accuracy of the calibration standards. Perform a matrix spike on at least one sample out of every ten samples. Additional information on quality control can be obtained from EPA Method 7470 or in Standard Methods for Water and Wastewater, 15th Edition, Method 303F.

8. Calculations

8.1 Dry Gas Volume. Using the data from this test, calculate $V_{m(std)}$, the dry gas sample volume at standard conditions (corrected for leakage, if necessary), as outlined in Section 6.3 of Method 5.

8.2 Volume of Water Vapor and Moisture Content. Using the data obtained from this test, calculate the volume of water vapor $V_{w(std)}$ and the moisture content B_{ws} of the stack gas. Use Equations 5-2 and 5-3 of Method 5.

8.3 Stack Gas Velocity. Using the data from this test and Equation 2-9 of Method 2, calculate the average stack gas velocity.

8.4 Metals in Source Sample.

8.4.1 Front Half (Filter and Probe), Lead, Cadmium, Chromium, and Arsenic. Calculate the amount of lead, cadmium, chromium, and arsenic collected in the front half of the sampling train using the following equation:

$$M_{fh} = C_a \, F_d \, F_a \, V_{soln} \qquad \text{Eq. 1}$$

where:

M_{fh} = total mass of metal (i.e., Pb, Cd, Cr, As) collected in the front half of the sampling train (Fraction 1), ug.

C_a = concentration of metal as read from the standard curve (ug/ml).

F_d = dilution factor (equals 1 if the sample has not been diluted).

F_a = aliquot factor = V_{soln}/V_a (equals 1 if the sample solution analyzed contains the entire sample collected).

V_{soln} = total volume of digested sample solution (Fraction 1), ml.

8.4.2 Back Half (Impinger 1-3), Lead, Cadmium, Chromium, and Arsenic. Calculate the amount of lead, cadmium, chromium, and arsenic collected in the back half of the sampling train using the following equation.

$$M_{bh} = C_a F_d F_a V_{soln} \qquad \text{Eq. 2}$$

where:

M_{bh} = total mass of metal (i.e., Pb, Cd, Cr, As) collected in the back half of the sampling train (Impingers 1-3), mg.

C_a = concentration of metal as read from the standard curve (ug/ml).

F_d = dilution factor (equals 1 if the sample has not been diluted).

F_a = aliquot factor = V_{soln}/V_a.

V_a = volume of sample aliquot analyzed, ml (equals V_{soln} - 50).

V_{soln} = total volume of digested sample solution (Fractions 2 and 3), ml.

8.4.3 Total Train, Lead, Cadmium, Chromium, and Arsenic. Calculate the total amount of each of the quantified metals collected in the sampling train as follows:

$$M_t = (M_{fh} - M_{fb}) + (M_{bh} - M_{bb}) \qquad \text{Eq. 3}$$

where:

M_t = total mass of metal collected in the sampling train, ug.

M_{fh} = total mass of metal collected in the front half of the sampling train (Fraction 1), ug.

M_{fb} = mass of metal detected in front half of field blank, ug.

M_{bh} = total mass of metal collected in the back half of the sampling train (Fractions 2 and 3), ug.

M_{bb} = mass of metal detected in back half of field blank, ug.

8.4.4 Determine Amount of Mercury Collected. Determine the amount of mercury in the 50 ml aliquot labeled Fraction 3 (Impingers 1-3) using Equation 4.

$$Hg_{F3} = C_a F_d F_a V_{soln} \qquad \text{Eq. 4}$$

where:

Hg_{F3} = total mass of mercury collected in Fraction 3 (Impingers 1-3 of the sampling train), ug.

C_a = concentration of mercury as read from the standard curve (ug/ml).
F_d = dilution factor (equals 1 if the sample has not been diluted).
F_a = aliquot factor = V_{soln}/V_a.
V_a = volume of aliquot used for sample analysis = 50 ml.
V_{soln} = total volume of sample solution Fractions 2 and 3, ml.

Determine the amount of mercury collected in Fraction 4 (Impinger 4) using Equation 5.

$$Hg_{F4} = C_a F_d F_a V_{soln} \qquad \text{Eq. 5}$$

where:

Hg_{F4} = total mass of mercury collected in Fraction 4 (Impinger 4 of the sampling train), ug.
C_a = concentration of mercury as read from the standard curve (ug/ml).
F_d = dilution factor (equals 1 if the sample has not been diluted).
F_a = aliquot factor = V_{soln}/V_a.
V_a = volume of aliquot used for sample analysis, ml.
V_{soln} = total volume of sample solution, Fraction 4, ml.

Calculate the total amount of mercury collected in the back half of the sampling train using Equation 6.

Note: No front half analysis is performed for mercury due to its volatility at probe and filter temperatures. Therefore, for the purpose of this procedure, mercury collected in the back half of the sampling train is presumed to represent total mercury in the stack gas.

$$M_t = (Hg_{F3} - Hg_{F3b}) + (Hg_{F4} - Hg_{F4b}) \qquad \text{Eq. 6}$$

where:

M_t = total mass of mercury collected in the back half of the sampling train, ug.

Hg_{F3} = total mass of mercury collected in Fraction 3 (Impingers 1-3 of the sampling train), ug.

Hg_{F3b} = total mass of mercury detected in Fraction 3 of the field blank, ug.
Hg_{F4} = total mass of mercury collected in Fraction 4 (Impinger 4 of the sampling train), ug.
Hg_{F4b} = total mass of mercury detected in Fraction 4 of the field blank, ug.

8.5 Metal Concentration of Stack Gas. Calculate the Pb, Cd, Cr, As, and Hg concentrations in the stack gas (dry basis, adjusted to standard conditions) as follows:

$$C_s = K_4 \left(M_t/V_{m(std)}\right) \qquad \text{Eq. 7}$$

where:

C_s = concentration of metal in the stack gas, mg/dscm.
K_4 = 10^{-3} mg/ug.
M_t = total mass of metal collected in the sampling train, ug.
$V_{m(std)}$ = volume of gas sample as measured by the dry gas meter, corrected to dry standard conditions, dscm.

8.6 Isokinetic Variation and Acceptable Results. Same as Method 5, Sections 6.11 and 6.12, respectively. To calculate the average stack gas velocity, use Equation 2-9 of Method 2 and the data from this field test.

9. Bibliography

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9.3 Methods 200.0, 206.2, 213.2, 239.2, and 270.2, Methods for Chemical Analysis of Water and Wastes. March 1979. Environmental Monitoring and Support Laboratory, Office of Research and Development, U. S. Environmental Protection Agency, Cincinnati, OH 45268.

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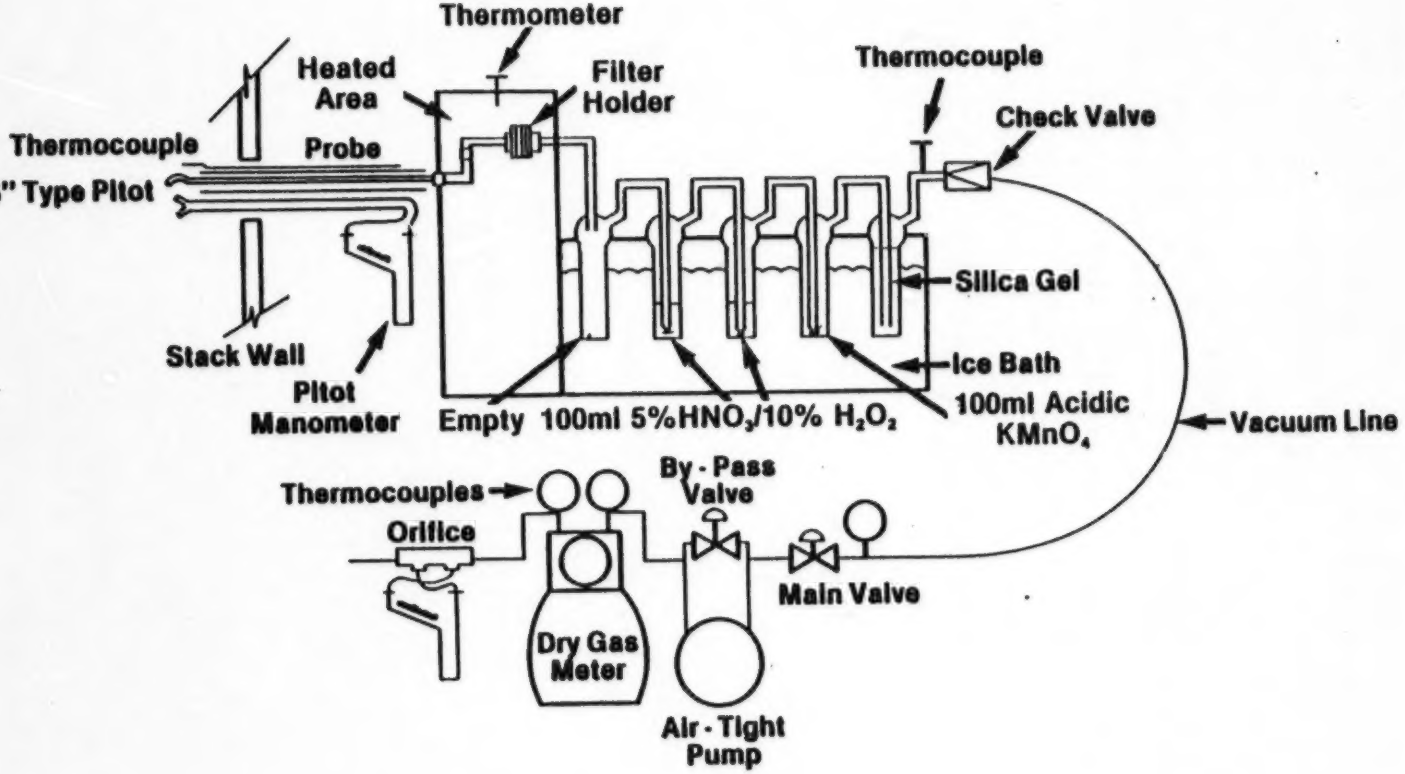

Figure 1. Trace Metals Sampling Train

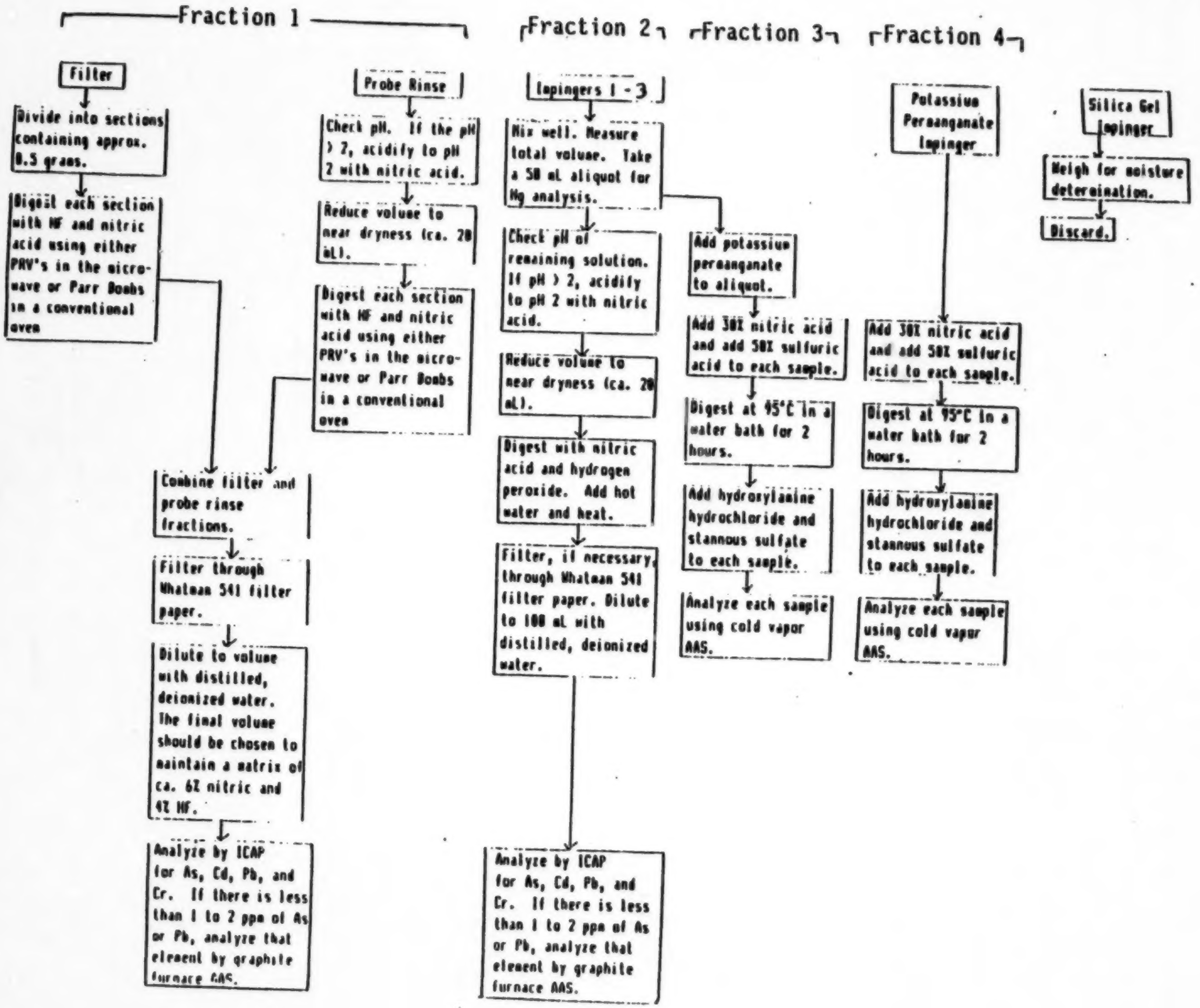
Fraction 1
Fraction 2
Fraction 3
Fraction 4
Filter
Divide into sections containing approx. 0.5 grams.
Digest each section with HF and nitric acid using either PRV's in the micro-wave or Parr Bombs in a conventional oven
Probe Rinse
Check pH. If the pH > 2, acidify to pH 2 with nitric acid.
Reduce volume to near dryness (ca. 20 mL).
Digest each section with HF and nitric acid using either PRV's in the micro-wave or Parr Bombs in a conventional oven
Combine filter and probe rinse fractions.
Filter through Whatman 541 filter paper.
Dilute to volume with distilled, deionized water. The final volume should be chosen to maintain a matrix of ca. 6% nitric and 4% HF.
Analyze by ICAP for As, Cd, Pb, and Cr. If there is less than 1 to 2 ppm of As or Pb, analyze that element by graphite furnace AAS.
Impingers 1 - 3
Mix well. Measure total volume. Take a 50 mL aliquot for Hg analysis.
Check pH of remaining solution. If pH > 2, acidify to pH 2 with nitric acid.
Reduce volume to near dryness (ca. 20 mL).
Digest with nitric acid and hydrogen peroxide. Add hot water and heat.
Filter, if necessary, through Whatman 541 filter paper. Dilute to 100 mL with distilled, deionized water.
Analyze by ICAP for As, Cd, Pb, and Cr. If there is less than 1 to 2 ppm of As or Pb, analyze that element by graphite furnace AAS.
Add potassium permanganate to aliquot.
Add 30% nitric acid and add 50% sulfuric acid to each sample.
Digest at 95°C in a water bath for 2 hours.
Add hydroxylamine hydrochloride and stannous sulfate to each sample.
Analyze each sample using cold vapor AAS.
Potassium Permanganate Impinger
Add 30% nitric acid and add 50% sulfuric acid to each sample.
Digest at 95°C in a water bath for 2 hours.
Add hydroxylamine hydrochloride and stannous sulfate to each sample.
Analyze each sample using cold vapor AAS.
Silica Gel Impinger
Weigh for moisture determination.
Discard.

Figure 2. Digestion and Analysis Procedure for Trace Metals Train

M.4 ASME Draft Methods

ANALYTICAL PROCEDURES TO ASSAY STACK EFFLUENT SAMPLES AND RESIDUAL COMBUSTION PRODUCTS FOR POLYCHLORINATED DIBENZO-p-DIOXINS (PCDD) AND POLYCHLORINATED DIBENZOFURANS (PCDF). A DRAFT ASME PROTOCOL DATED SEPTEMBER 18, 1984

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ANALYTICAL PROCEDURES TO ASSAY STACK EFFLUENT SAMPLES AND RESIDUAL COMBUSTION PRODUCTS FOR POLYCHLORINATED DIBENZO-p-DIOXINS (PCDD) AND POLYCHLORINATED DIBENZOFURANS (PCDF)

Prepared By

GROUP C - ENVIRONMENTAL STANDARDS WORKSHOP

Sponsored By

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, U.S. DEPARTMENT OF ENERGY AND U.S. ENVIRONMENTAL PROTECTION AGENCY

SEPT. 18, 1984

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1. Scope and Applicability of Method

The analytical procedures described here are applicable for the determination of polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF) in stack effluents from combustion processes. These methods are also applicable to residual combustion products such as bottom and precipitator ash. The methods presented entail addition of isotopically-labeled internal standards to all samples in known quantities, extraction of the sample with appropriate organic solvents, preliminary fractionation and cleanup of the extracts using a sequence of liquid chromatography columns, and analysis of the processed extract for PCDD and PCDF using coupled gas chromatography - mass spectrometry (GC-MS). Various performance criteria are specified herein which the analytical data must satisfy for quality assurance purposes. These represent minimum criteria which must be incorporated into any program in which PCDD and PCDF are determined in combustion product samples.

The method presented here does not yield definitive information on the concentration of individual PCDD/PCDF isomers, except for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and 2,3,7,8-Tetrachlorodibenzofuran (TCDF). Rather, it is designed to indicate the total concentration of the isomers of several chlorinated classes of PCDD/PCDF (that is, total tetra-, penta-, hexa-, hepta-, and octachlorinated dibenzo-p-dioxins and dibenzofurans). Of the 75 separate PCDD and 135 PCDF isomers, there are 22 TCDD, 38 TCDF, 14 PeCDD, 28 PeCDF, 10 HxCDD, 16 HxCDF, 2 HpCDD, 4 HpCDF, 1 OCDD and 1 OCDF.[a]

The analytical method presented herein is intended to be applicable for determining PCDD/PCDF present in combustion products at the ppt to ppm level, but the sensitivity which can ultimately be achieved for a given sample will depend upon the types and concentrations of other chemical compounds in the sample.

The method described here must be implemented by or under the supervision of chemists with experience in handling supertoxic materials and analyses should only be performed in rigorously controlled, limited access laboratories. The quantitation of PCDD/PCDF should be accomplished only by analysts experienced in utilizing capillary-column gas chromatography-mass spectrometry to accomplish quantitation of chlorocarbons and similar compounds at very low concentration.

The toxicological data which are available for the PCDD and PCDF are far from complete. That is, the toxicological properties of all of the isomers comprising the 75 possible PCDD and 135 possible PCDF are not presently known. However, a considerable body of toxicological data exists for 2,3,7,8-TCDD which indicates that, in certain animal species, this compound is lethal at extraordinarily low does and causes a wide range of systemic affects, including hepatic disorders, carcinoma and birth defects. While much less data is available regarding the toxicology of 2,3,7,8-TCDF, sufficient data is available to form the basis for the belief that 2,3,7,8-TCDF is similar in its toxicological properties to 2,3,7,8-TCDD. Relatively little is known about the toxicology of the higher chlorinated PCDD and PCDF (that is, penta through octachlorinated PCDD/PCDF), although there is some data to suggest that certain penta-, hexa-, and hepta- PCDD/PCDF isomers are hazardous. In view of the extraordinary toxicity of 2,3,7,8-TCDD and in view of the exceptional biological activity of this compound (on the basis of enzyme induction assays) and of compounds having similar molecular structures, extensive precautions are required to preclude exposure to personnel during handling and analysis of materials containing these compounds and to prevent contamination of the laboratory. Specific safety and handling procedures which are recommended are given in the Appendix to this protocol.

---

a.

The abbreviations which are used to designate chlorinated dibenzo-p-dioxins and dibenzofurans throughout this document are as follows:

PCDD - Any or all of the 75 possible chlorinated dibenzo-p-dioxin isomers

PCDF - Any or all of the 135 possible chlorinated dibenzofuran isomers

TCDD - Any or all of the 22 possible tetrachlorinated dibenzo-p-dioxin isomers

TCDF - Any or all of the 138 possible tetrachlorinated dibenzofuran isomers

PeCDD - Any or all of the 14 possible pentachlorinated dibenzo-p-dioxin isomers

PeCDF - Any or all of the 28 possible pentachlorinated dibenzofuran isomers

HxCDD - Any or all of the 10 possible hexachlorinated dibenzo-p-dioxin isomers

HXCDF - Any or all of the 16 possible hexachlorinated dibensofuran isomers

HpCDD - Any or all of the 2 possible heptachlorinated dibenzo-p-dioxin isomers

HpCDF - Any or all of the 4 possible heptachlorinated dibenzofuran isomers

OCDD - Octachlorodibenzo-p-dioxin

OCDF - Octachlorodibenzofuran

Specific Isomers. - Any of the abbreviations cited above may be converted to designate a specific isomer by indicating the exact positions (carbon atoms) where chlorines are located within the molecule. For example, 2,3,7,8-TCDD refers to only one of the 22 possible TCDD isomers - that isomer which is chlorinated in the 2,3,7,8 positions of the dibenzo-p-dioxin ring structure.

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2. Reagents and Chemicals

The following reagents and chemicals are appropriate for use in these procedures. In all cases, equivalent materials from other suppliers may also be used.

2.1 Potassium Hydroxide, Anhydrous, Granular Sodium Sulfate and Sulfuric Acid (all Reagent Grade): J. T. Baker Chemical Co. or Fisher Scientific Co. The granular sodium sulfate is purified prior to use by placing a beaker containing the sodium sulfate in a 400°C oven for four hours, then removing the beaker and allowing it to cool in a desiccator. Store the purified sodium sulfate in a bottle equipped with a Teflon-lined screw cap.

2.2 Hexane, Methylene Chloride, Benzene, Methanol, Toluene, Isooctane: "Distilled in Glass" Burdick and Jackson.

2.3 Tridecane (Reagent Grade): Sigma Chemical Co.

2.4 Basic Alumina (Activity Grade 1, 100 - 200 mesh): ICN Pharmaceuticals. Immediately prior to use, the alumina is activated by heating for at least 16 hours at 600°C in a muffle furnace and then allowed to cool in a desiccator for at least 30 minutes prior to use. Store pre-conditioned alumina in a desiccator.

2.5 Silica (Bio-Sil A, 100/200 mesh): Bio-Rad. The following procedure is recommended for conditioning the Bio-Sil A prior to use. Place an appropriate quantity of Bio-Sil A in a 30 mm x 300 mm long glass tube (the silica gel is held in place by glass wool plugs) which is placed in a tube furnace. The glass tube is connected to a pre-purified nitrogen cylinder, through a series of four traps (stainless steel tubes, 1.0 cm O.D. x 10 cm long)[6]: 1) Trap No. 1 - Mixture comprised of Chromosorb W/AW (60/80 mesh coated with 5% Apiezon L), Graphite (UCP-1-100), Activated Carbon (50 to 200 mesh) in a 7:1.5:1.5 ratio (Chromosorb W/AW, Apiezon L obtained from Supelco, Inc., Graphite obtained from Ultracarbon Corporation, 100 mesh, 1-M-USP; Activated Carbon obtained from Fisher Scientific Co.); 2) Trap No. 2 - Molecular Sieve 13 X (60/80 mesh), Supelco, Inc.; 3) Trap No. 3 - Carbosieve S (80/100 mesh), obtained from Supelco, Inc.; 4) The Bio-Sil A is heated in the tube for 30 minutes at 180°C while purging with nitrogen (flow rate 50-100 mL/minute), and the tube is then removed from the furnace and allowed to cool to room temperature. Methanol (175 mL) is then passed through the tube, followed by 175 mL methylene chloride. The tube containing the silica is then returned to the furnace, the nitrogen purge is again established (50-100 mL flow) and the tube is heated at 50°C for 10 minutes, then the temperature is gradually increased to 180°C over 25 minutes and maintained at 180°C for 90 minutes. Heating is then discontinued but the nitrogen purge is continued until the tube

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cools to room temperature. Finally, the silica is transferred to a clean, dry, glass bottle and capped with a Teflon-lined screw cap for storage.

2.6 Silica Gel Impregnated With Sulfuric Acid: Concentrated sulfuric acid (44 g) is combined with 100 g Bio-Sil A (conditioned as described above) in a screw capped bottle and agitated to mix thoroughly. Aggregates are dispersed with a stirring rod until a uniform mixture is obtained. The H_2SO_4-silica gel is stored in a screw-capped bottle (Teflon-lined cap).

2.7 Silica Gel Impregnated with Sodium Hydroxide: 1N Sodium hydroxide (39 g) is combined with 100 g Bio-Sil A (conditioned as described above) in a screw capped bottle and agitated to mix throughly. Aggregates are dispersed with a stirring rod until a uniform mixture is obtained. The NaOH-silica gel is stored in a screw-capped bottle (Teflon-lined cap).

2.8 Carbon/Celite:
Carbon: Amoco PX-21
Celite 545: Fisher Scientific Co

Combine Amoco PX-21 carbon (10.7 g) with Celite 545 (124 g) in a 250 mL glass bottle fitted with a Teflon-lined cap. Agitate the mixture to combine thoroughly. Store in the screw-capped bottle.

2.9 Sepralyte Diol (40µ): Analytichem International

2.10 Nitrogen and Hydrogen (Ultra High Purity): Matheson Scientific

3. Apparatus and Materials

The following apparatus and materials are appropriate for use in these procedures. In all cases, equivalent items from other suppliers may also be used.

3.1 Glassware used in the analytical procedures (including the Soxhlet apparatus and disposable bottles) is cleaned by rinsing successively three times with methanol and then three times with methylene chloride, and finally drying it in a 100°C oven. Bottles cleaned in this manner are allowed to cool to room temperature and are then capped using Teflon-lined lids. Teflon cap liners are rinsed as just described but are allowed to air-dry. More rigorous cleaning of some glassware with detergent may be required prior to the solvent rinses, for example, the glassware employed for Soxhlet extraction of samples.

3.1.1 Sample Vessels: 125 mL and 250 mL flint glass bottles fitted with screw caps and teflon cap liners, and glass test tubes, VWR-Scientific.

3.1.2 Teflon Cap Liners: Scientific Specialities Service, Inc.

3.1.3 Soxhlet Apparatus: Extraction apparatus, Allihn condenser, Kimax Brand, American Scientific Products Cat. No. E6252-2A.

3.1.4 Gravity Flow Liquid Chromatographic Columns: Custom Fabricated (Details of the columns are provided in later sections).

3.1.5 Micro-vials (3.0 mL): Reliance Glass.

3.2 Capillary Gas Chromatographic Columns: Two different columns are required if data on both 2,3,7,8-TCDD and 2,3,7,8-TCDF, as well as on the total PCDD/PCDF by chlorinated class, are desired. The appropriate columns are: 1) A fused silica column (60 M x 0.25 mm I.D.) coated with DB-5 (0.25 µ film thickness), J & S Scientific, Inc., Crystal Lake, IL is utilized to separate each of the several tetra-through octachlorinated CDDs and CDFs, as a group, from all of the other groups. While this column does not resolve all of the isomers within each chlorinated group, it effectively resolves each of the chlorinated groups from all of the other chlorinated groups and therefore provides data on the total concentration of each group (that is, total tetra-, penta-, hexa-, hepta- and octa CDDs and CDFs). This column also resolves 2,3,7,8-TCDD from all of the other 21 TCDD isomers and this isomer can therefore be determined quantitatively if proper calibration procedures are applied as described further in a later section. This column does not completely resolve 2,3,7,8-TCDF from the other TCDF isomers, and if a peak corresponding in retention time to 2,3,7,8-TCDF is observed in the analysis using this column, then a portion of the sample extract must be reanalyzed using the second GC column described below if isomer - specific data on 2,3,7,8-TCDF is desired. 2) A fused silica column (30 M x 0.25 mm I.D.) coated with DB-225 (0.25 µ film thickness), J & S Scientific, Inc., Crystal Lake, IL, must be utilized to obtain quantitative data on the concentration of 2,3,7,8-TCDF, since this column adequately resolves 2,3,7,8-TCDF from the other TCDF isomers.

3.3 Balance: Analytical Balance, readibility, 0.0001 g.

3.4 Nitrogen Blowdown Concentration Apparatus: N-Evap Analytical Evaporator Model III, Organomation Associates Inc.

3.5 Tube Furnace: Lindberg Type 59344.

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4. Instrumentation

Gas Chromatograph-Mass Spectrometer-Data System (GC/MS/DS): The instrument system used to analyze sample extracts for PCDD/PCDF comprises a gas chromatograph (fitted for capillary columns) coupled directly or through an enrichment device to a mass spectrometer which is equipped with a computer-based data system. The individual components of the GC/MS/DS are described below.

4.1 Gas Chromatograph (GC): The chromatograph must be equipped with an appropriate injector and pneumatic system to permit use of the specified glass or fused silica capillary columns. It must also incorporate an oven which can be heated in a reproducible, programmed temperature cycle. The injector should be configured for splitless/split injections. The GC column performance should be verified at the beginning of each 8 hour work period or at the beginning of each series of analyses if more than one set of samples is analyzed during an 8 hour shift. Extracts of complex combustion products and effluents may contain numerous organic residues even after application of the extensive prefractionation/cleanup procedures specified in this method. These residues may result in serious deviation of GC column performance and therefore, frequent performance checks are desirable. Using appropriate calibration mixtures, as described below, the retention time windows for each chlorinated class of CDDs/CDFs must be verified. In addition, the GC column utilized must be demonstrated to effectively separate 2,3,7,8-TCDD from all other TCDD isomers if data on 2,3,7,8-TCDD alone is desired with at least 20% valley definition between the 2,3,7,8- isomer and the other adjacent-eluting TCDD isomers. Typically, capillary column peak widths (at half-maximum peak height) on the order of 5-10 seconds are obtained in the course of these analyses. An appropriate GC temperature program for the analyses described herein is discussed in a later section (see Table 1).

4.2 Gas Chromatograph-Mass Spectrometer Interface: The GC-MS interface can include enrichment devices, such as a glass jet separator or a silicone membrane separator, or the gas chromatograph can be directly coupled to the mass spectrometer source, if the system has adequate pumping of the source region. The interface may include a diverter valve for shunting the column effluent and isolating the mass spectrometer source. All components of the interface should be glass or glass-lined stainless steel. The interface components must be compatible with temperatures in the neighborhood of 250°C, which is the temperature at which the interface is typically maintained throughout analyses for PCDD/PCDF. The GC/MS interface must be appropriately configured so that the separation of 2,3,7,8-TCDD from the other TCDD isomers which is achieved in the gas chromatographic column is not appreciably degraded. Cold spots and/or active surfaces (adsorption sites) in the GC/MS interface can cause peak tailing and peak broadening. If the latter are observed, thorough cleaning of the injection port, interface and connecting lines should be accomplished prior to proceeding.

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4.3 Mass Spectrometer (MS): The mass spectrometer used for the analyses described here is typically a double-focusing sector or quadrupole instrument equipped with an electron impact source (70 ev), maintained at 250°C, and a standard electron multiplier detector. If possible, it is desirable to have both low and high resolution capability with the mass spectrometer used, since confirmation of data obtained by low resolution MS using high resolution MS is sometimes desirable. Alternatively, a combination of mass spectrometers can be used for this purpose. The static resolution of the instrument must be maintained at a minimum of 1:500 (with a 10% valley between adjacent masses) if operating in the low resolution MS mode, and a minimum resolution of 1:10,000 is desirable for operation in the high resolution mode. The mass spectrometer must also be configured for rapid computer-controlled selected-ion monitoring in both high and low resolution operating modes. At a minimum, two ion-masses characteristic of each class of chlorinated dioxins should be monitored, and these are two ions in the molecular ion isotopic cluster. It is desirable for increased confidence in the data to also monitor the fragment ions arising from the loss of COCl from the molecular ion. In order to accomplish the requisite rapid multiple ion monitoring sequence during the time period defined by a typically capillary chromatographic peak (the base of the chromatographic peak is typically 15-20 seconds in width), the following MS performance parameters are typically required (assuming a 4-ion monitoring sequence for each class of PCDD/PCDF): dwell time/ion-mass, ≤100 msec.; minimum number of data points/chromatographic peak, 7 . The mass scale of the mass spectrometer is calibrated using high boiling perfluorokerosene and/or some other suitable mass standard depending upon the requirements of the GC-MS-DS system utilized. The actual procedures utilized for calibration of the mass scale will be unique to the particular mass spectrometer being employed. A list of the appropriate ions to be monitored in the PCDD/PCDF analyses described herein is presented in a later section (see Table 1).

4.4 Data System: A dedicated computer-based data system, capable of providing the data described above, is employed to control the rapid selected-ion monitoring sequence and to acquire the data. Both digital data (peak areas or peak heights) as well as peak profiles (displays of intensities of ion-masses monitored as a function of time) should be acquired during the analyses, and displayed by the data system. This raw data (mass chromatograms) should be provided in the report of the data.

5. Calibration Standards

A recommended set of calibration standards to be used in the analyses described herein is presented below. Stock standard solutions of the various PCDD and PCDF isomers and mixtures thereof are prepared in a glovebox, using weighed quantities of the authentic isomers.[b] These stock solutions are contained in appropriate volumetric flasks and are stored tightly stoppered, in a refrigerator. Aliquots of the stock standards are removed for direct use or for subsequent serial dilutions to prepare working standards. These standards must be checked regularly (by comparing instrument response factors for them over a period of

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time) to ensure that solvent evaporation or other losses have not occurred which would alter the standard concentration. The several recommended standard solutions are as follows.

5.1 Standard Mixture A: Prepare a stock solution containing the following isotopically-labelled PCDD and PCDF in isooctane at the indicated concentrations: 2.5ng./µl $^{13}C_{12}$-2,3,7,8-TCDD, 2.5ng/µl $^{37}Cl_4$-2,3,7,8-TCDF, 25ng/µL $^{13}C_{12}$-1,2,3,4,7,8-HxCDD, 25ng/µL $^{13}C_{12}$-1,2,3,4,7,8-HxCDF, 25ng/µL $^{13}C_{12}$-OCDD, and 25ng/µL $^{13}C_{12}$-OCDF. Portions of this isomer mixture are added to all samples prior to analyses and serve as internal standards for use in quantitation. Recovery of these standards is also used to guage the overall efficacy of the analytical procedures.

5.2 Standard B: Prepare a stock solution containing 1.0 ng of $^{37}Cl_4$-2,3,7,8-TCDD/µL of isooctane. This standard can be coinjected if desired, along with aliquots of the final sample extract to reliably estimate the recovery of the $^{13}C_{12}$-2,3,7,8-TCDD surrogate standard.

5.3 Standard Mixture C: Prepare a stock solution containing 100 ng/µL of isooctane of each of the following PCDD and PCDF: 2,3,7,8-TCDF; 2,3,7,8-TCDD; 1,3,4,6,8-PeCDF, 2,3,4,6,7-PeCDF; 1,2,4,7.9-PeCDD; 1,2,3,8,9-PeCDD; 1,2,3,4,6,8-HxCDF; 2,3,4,6,7,8-HxCDF; 1,2,3,4,6,8-HxCDD, 1,2,3,4,6,7-HxCDD; 1,2,3,4,6,7,8-HpCDF; 1,2,3,4,7,8,9-HpCDF; 1,2,3,4,6,7,8-HpCDD; 1,2,3,4,6,7,9-HpCDD; OCDF: and OCDD. This isomer mixture is used to define the gas chromatographic retention time intervals or windows for each of the penta-, hexa-, hepta-, and octachlorinated groups of PCDD and PCDF. Each pair of isomers of a given chlorinated class which is listed here corresponds to the first and last eluting isomers of that class on the DB-5 capillary GC column (except for TCDD and TCDF). In addition, this isomer mixture is used to determine GC-MS response factors for representative isomers of each of the penta-, hexa-, hepta-, and octachlorinated groups of PCDD and PCDF. The later data are used in quantitating the analytes in unknown samples.

5.4 Standard Mixture D: Prepare a stock solution containing 50 pg/µL of isooctane of each of the following TCDD isomers: 1,3,6,8-TCDD; 1,2,3,7-TCDD; 1,2,3,9-TCDD; 2,3,7,8-TCDD; and 1,2,8,9-TCDD. Two of the isomers in this mixture are used to define the gas chromatographic retention time window for TCDDs (1,3,6,8-TCDD is the first eluting TCDD

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[b] Some of the PCDD/PCDF isomer standards recommended for this method are available from Cambridge Isotope Laboratories, Cambridge, Massachusetts. Other PCDD/PCDF standards are available from the Brehm Laboratory, Wright State University, Dayton, Ohio, from the U.S. EPA Standard Repository at Research Triangle Park, North Carolina and possibly from other laboratories. Not all of the indicated isotopically-labelled PCDD/PCDF internal standards recommended here are presently available in quantities sufficient for widespread distribution, but these are expected to be available in the near future.

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isomer and 1,2,8,9-TCDD is the last eluting TCDD isomer on the DB-5 GC column). The remaining isomers serve to demonstrate that the 2,3,7,8-TCDD isomer is resolved from the other nearest eluting TCDD isomers, and that the column therefore yields quantitative data for the 2,3,7,8-TCDD isomer alone.

5.5 Standard Mixture E: Prepare a stock solution containing 50 pg/uL of isooctane of each of the following TCDF isomers: 1,3,6,8-TCDF; 2,3,4,8-TCDF; 2,3,7,8-TCDF, 2,3,4,7-TCDF; and 1,2,8,9-TCDF. This isomer mixture is used to define the TCDF gas chromatographic retention time window (1,3,6,8- and 1,2,8,9-TCDF are the first and last eluting TCDFs on the DB-5 capillary column) and to demonstrate that 2,3,7,8-TCDF is uniquely resolved from the adjacent-eluting TCDF isomers.

6. Procedures for Addition of Internal Standards and Extraction of Samples

Both liquid and solid samples will be obtained for PCDD/PCDF analyses as a result of the application of an appropriate stack sampling procedure. Samples resulting from the sampling train will include the following (these will be provided to the analytical laboratory as separate samples in the form indicated): 1) particulate filter and particulates thereon; 2) particulates from the cyclone (if used); 3) combined aqueous solutions from the impingers; 4) the intact XAD-resin cartridge and the resin therein; 5) combined aqueous rinse (if used) solutions from rinses of the nozzle, probe, filter holder, cyclone (if used), impingers, and all connecting lines; 6) combined acetone rinse solutions from rinses of the nozzle, probe, filter holder, cyclone (if used), impingers, and all connecting lines; 7) combined hexane rinse solutions from rinses of the nozzle, probe, filter, cyclone (if used), impingers, and all connecting lines. In addition, samples of bottom ash, precipitator ash, incinerator feed materials or fuel, quench liquids, and materials from effluent control devices may also be provided for analyses.

In general, the volumes of all liquid samples received for analyses are measured and recorded, and where appropriate, solid samples or aliquots thereof are weighed. Any samples which are homogeneous (as for example, a single liquid phase sample or a solid which can be thoroughly mixed) can be split prior to analyses, if desired, provided that this will still permit the attainment of the desired detection limits for the analytes of interest. Samples such as particulates from the sampling train which are generally collected in relatively small quantity, are preferably analyzed in total.

6.1 Organic Liquid Samples (Acetone and Hexane Solutions) Concentrate each of the combined organic liquids (acetone and hexane solutions) to a volume of about 1-5 mL using the nitrogen blowdown

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apparatus (a stream of dry nitrogen) while heating the sample gently on a water bath. Pool the concentrated residues, rinsing the vessels three times with small portions of hexane and adding these to the residues, and concentrate to near dryness. This residue will likely contain particulates which were removed in the rinses of the train probe and nozzle. Combine the residue (along with three rinses of the final sample vessel) in the Soxhlet apparatus with the filter and particulates, and proceed as described under Solid Sample below.

6.2 Aqueous Liquids

Add an appropriate quantity of the isotopically-labeled internal standard mixture (Standard Mixture A described earlier) to the aqueous liquid sample (or an aliquot thereof) in a screw-capped bottle fitted with a Teflon-lined cap. Add approximately 25% by volume of hexane to the spiked aqueous sample, seal the bottle and agitate on a shaker for a period of three hours. Allow the vessel to stand until the aqueous and organic layers separate, then transfer the organic layer to a separate sample bottle. Repeat the hexane extraction sequence two additional times and combine the organic fractions with that from the first extraction. Proceed with the sample fractionation and cleanup procedures described below.

6.3 Solid Samples

Place a glass extraction thimble and 1 g of silica gel and a plug of glass wool into the Soxhlet apparatus, charge the apparatus with toluene and reflux for a period of one hour. Remove the toluene and discard it, retaining the silica gel, or if desired, retain a portion of the toluene to check for background contamination. For extraction of particulates, place the entire sample in the thimble onto the bed of precleaned silica gel (1 cm. thick), and top with the precleaned glass wool retained from the initial Soxhlet cleaning procedure. Add the appropriate quantity of the isotopically-labelled internal standard mixture (Standard Mixture A described earlier) to the sample in the Soxhlet thimble. Charge the Soxhlet with toluene and reflux for a period of 16 hours. After extraction, allow the Soxhlet to cool, remove the toluene extract, and transfer it to another sample vessel. Concentrate the extract to a volume of approximately 40 ml by using the nitrogen blowdown apparatus described earlier. Proceed with the sample fractionation and cleanup procedures described below.

7. Procedures for Cleanup and Fractionation of Sample Extracts

The following column chromatographic sample clean-up procedures are used in the order given, although not all may be required. In general, the silica and alumina column procedures are considered to be a minimum requirement. Acceptable alternative cleanup procedures may be used provided that they are demonstrated to effectively transmit a representative set of the analytes of interest. The column chromatographic procedures listed here have been demonstrated to be effective for a mixture consisting of 1,2,3,4-TCDD, 2,3,7,8-TCDD, 2,3,6,8-TCDF, 1,2,4,8-TCDF, 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 1,2,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDD, 1,2,4,6,7.9-HxCDF, 1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,8,9-HpCDF, OCDD and OCDF

An extract obtained as described in the foregoing sections is concentrated to a volume of about 1 mL using the nitrogen blowdown apparatus, and this is transferred quantitatively (with rinsings) to the combination silica gel column described below.

7.1 Combination Silica Gel Column: Pack one end of a glass column (20 mm. O.D. x 230 mm in length) with glass wool (precleaned) and add, in sequence, 1 g silica gel, 2 g base-modified silica gel, 1 g silica gel, 4 g acid-modified silica gel, and 1 g silica gel. (Silica gel and modified silica gel are prepared as described in the Reagents sections of this protocol.) Preelute the column with 30 mL hexane and discard the eluate. Add the sample extract in 5 mL of hexane to the column along with two additional 5 ml rinses. Elute the column with an additional 90 mL of hexane and retain the entire eluate. Concentrate this solution to a volume of about 1 ml.

7.2 Basic Alumina Column: Cut off a 10 mL disposable Pasteur glass pipette at the 4 mL graduation mark and pack the lower section with glass wool (precleaned) and 3 g of Woelm basic alumina (prepared as described in the Reagent section of this protocol). Transfer the concentrated extract from the combination silica column to the top of the column and elute the column sequentially with 15 mL of hexane, 10 mL of 8% methylene chloride-in-hexane and 15 mL of 50% methylene chloride-in-hexane, discarding the first two eluate fractions and retaining the third eluate fraction. Concentrate the latter fraction to about 0.5 mL using the nitrogen blowdown apparatus described earlier.

7.3 PX-21 Carbon/Celite 545 Column: Take a 9 inch disposable Pasteur pipette and cut off a 0.5 inch section from the constricted tip. Insert a filter paper disk at the top of the tube, 2.5 cm. from the constriction. Add a sufficient quantity of PX-21 Carbon/Celite 545 (Prepared as described in the reagent section of this protocol) to the tube to form a 2 cm. length of the Carbon-Celite. Insert a glass wool plug. Preelute the column in sequence with 2 mL of 50% benzene-in-ethyl acetate, 1 mL of 50% methylene chloride-in-cyclohexane and 2 mL of hexane, and discard these eluates. Load the extract (in 1 mL of hexane) from the alumina column onto the top of the column, along with 1 mL hexane rinse. Elute the column with 2 mL of 50% methylene chloride-in-hexane and 2 mL of 50% benzene-in-ethyl acetate and discard these eluates. Invert the column and reverse elute it with 4 mL of toluene, retaining this eluate. Concentrate the eluate and transfer it to a Reacti-Vial for storage. Store extracts in a freezer, shielded from light, prior to GC-MS analysis. If desired, still another column chromatographic clean-up step can be employed prior to concentration of the extract, as described below.

7.4 Silica/Diol Micro Column Cleanup: After the above clean-up steps small amounts of highly colored polar compounds may be present in complex samples. These are removed, if necessary, by the following column: Push a small plug of glass wool into a disposable 6 mm i.d. glass Pasteur pipette, followed by 3 mm of Sepralyte (Analytichem International), 6 mm of silica gel and finally 3 mm of sodium sulfate. The column is pre-wet with hexane, the sample is applied in 100 µL of 100% hexane and eluted with hexane, collecting 1.5 ml.

8. Procedure for Analysis of Sample Extracts for PCDD/PCDF Using Gas Chromatography-Mass Spectrometry (GC-MS).

8.1 Sample extracts prepared by the procedures described in the foregoing are analyzed by GC-MS utilizing the following instrumental parameters. Typically, 1 to 5 µL portions of the extract are injected into the GC. Sample extracts are first analyzed using the DB-5 capillary GC column to obtain data on the concentrations of total tetra-through octa-CDDs and CDFs, and on 2,3,7,8-TCDD. If tetra-CDFs are detected in this analysis, then another aliquot of the sample is analyzed in a separate run, using the DB-225 column to obtain data on the concentration of 2,3,7,8-TCDF.

8.2 Gas Chromatograph

8.2.1 Injector: Configured for capillary column, splitless/split injection (split flow on 60 seconds following injection), injector temperature, 250°C.

8.2.2 Carrier gas: Hydrogen, 30 lb head pressure.

8.2.3 Capillary Column 1: For total tetra- through octa - CDDs/CDFs and 2,3,7,8-TCDD, 60 M x 0.25 mm I.D. fused silica DB-5; temperature programmed (see Table 1 for temperature program). Capillary Column 2: for 2,3,7,8-TCDF only, 60 M x 0.25 mm I.D. fused silica DB-225, temperature programmed (180°C for 1 min., then increase from 180°C to 240°C @ 5°C/min., hold at 240°C for 1 min.)

8.2.4 Interface Temperature: 250°C

8.3 Mass Spectrometer

8.3.1 Ionization Mode: Electron impact (70 eV)

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8.3.2 Static Resolution: 1:600 (10% valley) or 1:10,000 depending upon requirements. Usually the sample extracts are initially analyzed using low resolution MS, then if PCDD/PCDF are detected, it is desirable to analyze a second portion of the sample extract using high resolution MS.

8.3.3 Source Temperature: 250°C

8.3.4 Ions Monitored: Computer-Controlled Selected-Ion Monitoring. See Table 1 for list of ion masses monitored and time intervals during which ions characteristic of each class of CDDs and CDFs are monitored.

8.4 Calibration Procedures:

8.4.1 Calibrating the MS Mass Scale: Perfluoro Kerosene, decafluorotriphenyl phosphine, or any other accepted mass marker compound must be introduced into the MS, in order to calibrate the mass scale through at least m/z 500. The procedures specified by the manufacturer for the particular MS instrument used are to be employed for this purpose. The mass calibration should be rechecked at least at 8 hr. operating intervals.

8.4.2 Table 1 shows the GC temperature program typically used to resolve each chlorinated class of PCDD and PCDF from the other chlorinated classes, and indicates the corresponding time intervals during which ions indicative of each chlorinated class are monitored by the MS. This temperature program and ion monitoring time cycle must be established by each analyst for the particular instrumentation used by injecting aliquots of Standard Mixtures C, D. and E (See earlier section of this protocol for description of these mixtures). It may be necessary to adjust the temperature program and ion monitoring cycles slightly based on the observations from analysis of these mixtures.

8.4.3 Checking GC Column Resolution for 2,3,7,8-TCDD and 2,3,7,8-TCDF: Utilize the column-resolution TCDD and TCDF isomer mixtures (Standard Mixtures D and E, containing 50 pg/μl, respectively of the appropriate TCDD and TCDF isomers) to verify that 2,3,7,8-TCDD and 2,3,7,8-TCDF are separated from the other TCDD and TCDF isomers, respectively. A 20% valley or less must be obtained between the mass chromatographic peak observed for 2,3,7,8-TCDD and adjacent peaks arising from other TCDD isomers, and similar separation of 2,3,7,8-TCDF from other neighboring TCDFs, is required. Standard Mixture D is utilized with the DB5 column and Standard Mixture E with the DB-225 column. Analyze the column performance standards using the instrumental parameters specified in Sections 8.2 and 8.3, and in Table 1. The column performance evaluation must be performed each time a new column is installed in the gas chromatograph, and at least once during each 8 hour operating period. Providing that the same column is employed for a period of time, its performance can also be gauged by noting the peak width (at 1/2 peak height) for 2,3,7,8-TCDD or for 2,3,7,8-TCDF. If this peak width is observed to broaden by 20% or more as compared to the usual width for satisfactory operation, then the column resolution is suspect and must be checked. If the column resolution is found to be insufficient to resolve 2,3,7,8-TCDD and 2,3,7,8-TCDF from their neighboring TCDD and TCDF isomers, respectively, (as measured on the two different columns used for resolving these two isomers), then a new DB-5 and/or DB-225 GC column must be installed.

8.4.4 Calibration of the GC-MS-DS system to accomplish quantitative analysis of 2,3,7,8-TCDD and 2,3,7,8-TCDF, and of the total tetra- through octa-CDDs and CDFs contained in the sample extract, is accomplished by analyzing a series of at least three working calibration standards. Each of these standards is prepared to contain the same concentration of each of the stable-isotopically labelled internal standards used here (Standard Mixture A) but a different concentration of native PCDD/PCDF (Standard Mixture C). Typically, mixtures will be prepared so that the ratio of native PCDD and PCDF to isotopically-labelled PCDD and PCDF will be on the order of 0.1, 0.5 and 1.0 in the three working calibration mixtures. The actual concentrations of both native and isotopically-labelled PCDD and PCDF in the working calibration standards will be selected by the analyst on the basis of the concentrations to be measured in the actual sample extracts. At the time when aliquots of each of the standards are injected (and also when injecting aliquots of actual sample extracts), if desired, an aliquot of a standard containing typically 1 ng of $^{37}Cl_4$-2,3,7,8-TCDD (Standard B) can be drawn into the micro syringe containing the calibration solution described above (or the sample extract) and this is then co-injected along with the sample extract in order to obtain data permitting calculation of the percent recovery of the $^{13}C_{12}$-2,3,7,8-TCDD internal standard. Equations for calculating relative response factors from the calibration data derived from the calibration standard analyses, and for calculating the recovery of the $^{13}C_{12}$-2,3,7,8-TCDD and the other isotopically-labelled PCDD and PCDF, and the concentration of native PCDD and PCDF in the sample (from the extract analysis), are summarized below. In these calculations, as can be seen, 2,3,7,8-TCDD is employed as the illustrative model. However, the calculations for each of the other native dioxins and furans in the sample analyzed are accomplished in an analgous manner. It should be noted that in view of the fact that stable-isotopically labelled internal standards corresponding to each tetra- through octachlorinated class are not used here (owing to limited availability at this time) the following approach is adopted: For quantitation of tetrachlorinated dibenzofurans $^{13}C_{12}$-2,3,7,8-TCDF is used as the internal standard. For quantitation of tetrachlorodibenzo-p-dioxins, $^{13}C_{12}$-2,3,7,8-TCDD is used as the internal standard. For quantitation of PeCDD, HxCDD, PeCDF, and HxCDF, the corresponding stable-isotopically labelled HxCDD and HxCDF internal standards are used. For quantitation of HpCDD, OCDD, and HpCDF, OCDF, the isotopically-labelled OCDD and OCDF, respectively, are used. Inherent in this approach is the assumption that the response factors for each of the isomers

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of each chlorinated class are the same, and in the case of the penta- and hepta-CDDs and CDFs, the assumption is made that the responses for these two classes are equivalent to those for the tetra-isomers and the octa-isomers, respectively.

8.4.5 Equations for Calculating Response Factors, Concentration of 2,3,7,8-TCDD In An Unknown Sample, and Recoveries of Internal Standards.

Equation 1: Response Factor (RRF) for native 2,3,7,8-TCDD using $^{13}C_{12}$-2,3,7,8-TCDD as an internal standard.

$$RRF_d = (A_s C_{is} / A_{is} C_s)$$

where: A_s = SIM response for 2,3,7,8-TCDD ion at m/z 320 + 322

A_{is} = SIM response for $^{13}C_{12}$-2,3,7,8-TCDD internal standard ion at m/z 332

C_{is} = Concentration of the internal standard (pg./µL.)

C_s = Concentration of the 2,3,7,8-TCDD (pg./µL.)

Equation 2: Response Factor (RRF) for $^{37}Cl_4$-2,3,7,8-TCDD, the co-injected external standard

$$RRF_f = (A_{is} C_{es})/(A_{es} C_{is})$$

where: A_{is} = SIM response for $^{13}C_{12}$-2,3,7,8-TCDD internal standard ion at m/z 332

A_{es} = SIM response for co-injected $^{37}Cl_4$-2,3,7,8-TCDD external standard at m/z 328 - 0.009 (SIM response for native 2,3,7,8-TCDD at m/z 322)

C_{is} = Concentration of the internal standard (pg./µL.)

C_{es} = Concentration of the external standard (pg./µL.)

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Equation 3: Calculation of concentration of native 2,3,7,8-TCDD using $^{13}C_{12}$-2,3,7,8-TCDD as internal standard

Concentration, pg./g. = $(A_s)\ (I_s)/(A_{is})(RRF_d)(W)$

where: A_s = SIM response for 2,3,7,8-TCDD ion at m/z 320 + 322

A_{is} = SIM response for the $^{13}C_{12}$-2,3,7,8-TCDD internal standard ion at m/z 332

I_s = Amount of internal standard added to each sample (pg.)

W = Weight of soil or waste in grams

RRF_d = Relative response factor from Equation 1

Equation 4: Calculation of % recovery of $^{13}C_{12}$-2,3,7,8-TCDD internal standard

% Recovery = $100(A_{is})(E_s)/(A_{es})(I_i)(RRF_f)$

A_{is} = SIM response for $^{13}C_{12}$-2,3,7,8-TCDD internal standard ion at m/z 332

A_{es} = SIM response for $^{37}Cl_4$-2,3,7,8-TCDD external standard ion at m/z 328 - 0.009 (SIM Response for native 2,3,7,8-TCDD at m/z 322)

E_s = Amount of $^{37}Cl_4$-2,3,7,8-TCDD external standard co-injected with sample extract (ng.)

I_i = Theoretical amount of $^{13}C_{12}$-2,3,7,8-TCDD internal standard in injection

RRF_f = Relative response factor from Equation 2

As noted above, procedures similar to these are applied to calculate analytical results for all of the other PCDD/PCDF determined in this method.

8.5 Criteria Which GC-MS Data Must Satisfy for Identification of PCDD/PCDF in Samples Analyzed and Additional Details of Calculation Procedures.

In order to identify specific PCDD/PCDF in samples analyzed, the GC-MS data obtained must satisfy the following criteria:

8.5.1 Mass spectral responses must be observed at both the molecular and fragment ion masses corresponding to the ions indicative of each chlorinated class of PCDD/PCDF identified (see Table 1) and intensities of these ions must maximize essentially simultaneously (within ± 1 second). In addition, the chromatographic retention times observed for each PCDD/PCDF signal must be correct relative to the appropriate stable-isotopically labelled internal standard and must be consistent with the retention time windows established for the chlorinated group to which the particular PCDD/PCDF is assigned.

8.5.2 The ratio of the intensity of the molecular ion $(M)^{+\cdot}$ signal to that of the $(M+2)^{+}$ signal must be within ± 10% of the theoretically expected ratio (for example, 0.77 in the case of TCDD; therefore the acceptable range for this ratio is 0.62 to 0.92).

8.5.3 The intensities of the ion signals are considered to be detectable if each exceeds the baseline noise by a factor of at least 3:1. The ion intensities are considered to be quantitatively measurable if each ion intensity exceeds the baseline noise by a factor of at least 5:1[c].

8.5.4 For reliable detection and quantitation of PCDF it is also desirable to monitor signals arising from chlorinated diphenyl ethers which, if present could give rise to fragment ions yielding ion masses identical to those monitored as indicators of the PCDF. Accordingly, in Table 1, appropriate chlorinated diphenyl ether masses are specified which must be monitored simultaneously with the PCDF ion-masses. Only when the response for the diphenyl ether ion mass is not detected at the same time as the PCDF ion mass can the signal obtained for an apparent PCDF be considered unique.

8.5.5 Measurement of the concentration of the congeners in a chlorinated class using the methods described herein is based on the assumption that all of the congeners are identical to the calibration standards employed in terms of their respective chemical and separation properties and in terms of their respective gas chromatographic and mass spectrometric responses. Using these assumptions, for example, the $^{13}C_{12}$-2,3,7,8-TCDD internal standard is utilized as the internal calibration standard for all of the 22 TCDD isomers or congeners. Furthermore, the concentration of the total TCDD present in a sample extract is determined by calculating, on the basis of the standard procedure outlined above, the concentration of each TCDD isomer peak (or peaks for multiple TCDD isomers, where these coelute) and these individual concentrations are subsequently summed to obtain the concentration of "total" TCDD.

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[c] In practice, the analyst can estimate the baseline noise by measuring the extension of the baseline immediately prior to each of the two mass chromatographic peaks attributed to a given PCDD or PCDF. Spurious signals may arise either from electronic noise or from other organic compounds in the extract. Since it may be desirable to evaluate the judgement of the analyst in this respect, copies of original mass chromatograms must be included in the report of analytical results.

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8.6 Frequently, during the analysis of actual sample extracts, extraneous compounds which are present in the extract (those organic compounds not completely removed during the clean-up phase of the analysis) can cause changes in the liquid and gas chromatographic elution characteristics of the PCDD/PCDF (typically retention times for the PCDD/PCDF are prolonged). Such extraneous organic compounds, when introduced into the mass spectrometer source may also result in a decrease in the sensitivity of the MS because of suppression of ionization, and other affects such as charge transfer phenomena. The shifts in chromatographic retention times are usually general shifts, that is, the relative retention times for the PCDD/PCDF are not changed, although the entire elution time scale is prolonged. The analyst's intervention in the GC-MS operating sequence can correct for the lengthened GC retention times which are sometimes observed due to the presence of extraneous organics in the sample extract. For example, using the program outlined in Table 1, if the retention time observed for 2,3,7,8-TCDD (which normally is 19.5 minutes) is lengthened by 30 seconds or more, appropriate adjustments in the programming sequence outlined in Table 1 can be made, that is, each selected ion-monitoring program is delayed by a length of time proportionate to the lengthening of the retention time for the 2,3,7,8-TCDD isomer. In the case of ionization suppression, this phenomenon is inherently counteracted by the internal standard approach. However, if loss of sensitivity due to ionization suppression is severe, additional clean-up of the sample extract may be required in order to achieve the desired detection limits.

9. Quality Assurance/Quality Control

9.1 Quality assurance and quality control are ensured by the following provisions:

9.1.1 Each sample analyzed is spiked with stable isotopically labelled internal standards, prior to extraction and analysis. Recoveries obtained for each of these standards should typically be in the range from 60-90%. Since these compounds are used as true internal standards however, lower recoveries do not necessarily invalidate the analytical results for native PCDD/PCDF, but may result in higher detection limits than are desired.

9.1.2 Processing and analysis of at least one method blank sample is accomplished for each set of samples (a set being defined as 20 samples or less).

9.1.3 It is desirable to analyze at least one sample spiked with representative native PCDD/PCDF for each set of 20 or fewer samples. The result of this analysis provides an indication of the efficacy of the entire analytical procedure. The results of this analysis will be considered acceptable if the detected concentration of each of the native

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PCDD/PCDF added to the sample is within ±50% of the known concentration. (An appropriate set of native isomers to be added here is a set such as that indicated for Standard Mixture C.)

9.1.4 At least one of the samples analyzed out of each set (of 20 samples or less) is analyzed in duplicate and the results of the duplicate analysis are included in the report of data.

9.1.5 Performance evaluation samples prepared by EPA, or other laboratories, which contain representative PCDD/PCDF in concentrations approximating those present in typical field samples being analyzed (but unknown to the analyzing lab) should be periodically distributed to laboratories accomplishing these analyses.

9.1.6 Sources of all calibration and performance standards used in the analyses and the purity of these materials must be specified in the data report.

10. Data Reporting

10.1 Each report of analyses accomplished using the protocol described herein will typically include tables of results which include the following:

10.1.1 Complete identification of the samples analyzed (sample numbers and source).

10.1.2 The dates and times at which all analyses were accomplished. This information should also appear on each mass chromatogram included with the report.

10.1.3 Raw mass chromatographic data which consists of the absolute intensities (based on either peak height or peak area) of the signals observed for the ion-masses monitored (See Table 1).

10.1.4 The calculated ratios of the intensities of the molecular ions for all PCDD/PCDF detected.

10.1.5 The calculated concentrations of native 2,3,7,8-TCDD and 2,3,7,8-TCDF, and the total concentrations of the congeners of each class of PCDD/PCDF for each sample analyzed, expressed in nanograms TCDD per gram of sample (that is, parts-per-billion) as determined from the raw data. If no PCDD/PCDF are detected, the notation "Not Detected" or "N.D." is used, and the minimum detectable concentrations (or detection limits) are reported.

10.1.6 The same raw and calculated data which are provided for the actual samples will also be reported for the duplicate analyses, the method blank analyses, the spiked sample analyses and any other QA or performance samples analyzed in conjunction with the actual sample set(s).

10.1.7 The recoveries of the internal standards in percent.

10.1.8 The recoveries of the native PCDD/PCDF from spiked samples in percent.

10.1.9 The calibration data, including response factors calculated from the three point calibration procedure described elsewhere in this protocol. Data showing that these factors have been verified at least once during each 8 hour period of operation or with each separate set of samples analyzed must be included.

10.1.10 The weight or quantity of the original sample analyzed.

10.1.11 Documentation of the source of all PCDD/PCDF standards used and available specifications on purity.

10.1.12 In addition to the tables described above, each report of analyses will include all mass chromatograms obtained for all samples analyzed, as well as for all calibration, GC column performance, and GC "window" definition runs and results of column performance checks.

10.1.13 Any deviations from the procedures described in this protocal which are applied in the analyses of samples will be documented in detail in the analytical report.

11. Typical Data Indicative of Method Performance - Precision and Accuracy.

11.1 The method described herein has typically been employed to quantitatively determine 2,3,7,8-TCDD in combustion product samples at concentrations as low as 10 picograms/gram and as high at 100 µg/g. Concentrations of the other PCDD/PCDF which can be detected typically fall within the range of 20 picograms/isomer/gram of sample, to 100 picograms/g of sample. Of course, the limits of detection which can be practically achieved are dependent on the quantity of sample available and the amount and kind of other interferring organic residues which are present in the sample. With respect to precision, the average deviation of data obtained from the analyses of a number of aliquots of the same sample containing the 2,3,7,8-TCDD isomer in the 250-300 ppb range is estimated to be ±10% or better. Data on the precision of quantitation of multiple PCDD/PCDF in a single sample are not as yet available. As yet, there is inadequate interlaboratory and performance evaluation data available to specify the accuracy which can be expected of the analytical procedures described herein.

TABLE 1. Sequence of Operations in GC-MS-DS Quantitation of CDDs/CDFs in Extracts of Environmental Samples

Elapsed Time (min)	Event	GC Column Temperature* (°C)	Temperature Program Rate (°C/min)	Ions Monitored by Mass Spectrometer (m/z)	Identity of Fragment Ion	Compounds Monitored	Approximate Theoretical Ratio of $[M]^+:[M+2]^+$
0.00	Injection, splitless	190					
1.00	Turn on split valve	190					
1.00	Begin temp. program to 220°C	190	5				
6.00	Open column flow to mass spectrometer	215	5				
7.00	Column temperature hold	220					
14.00	Start Tetra Program; sweep = 350 ppm; time/mass = 0.00 sec.			240.938	$[M-COCl]^+$	TCDF	
				258.930	$[M-COCl]^+$	TCDD	
				303.902	$[M]^+$	TCDF	0.77
				305.899	$[M+2]^+$	TCDF	
				315.942	$[M]^+$	${}^{13}C_{12}$-TCDF	
				319.897	$[M]^+$	TCDD	0.77
				321.894	$[M+2]^+$	TCDD	
				327.885	$[M]^+$	${}^{37}Cl_4$-TCDD	
				331.937	$[M]^+$	${}^{13}C_{12}$-TCDD	
				373.840	$[M]^+$	HxDPE^a.	
22.00	Stop Tetra Program	220					
22.50	Start Penta Program; sweep = 350 ppm; time/mass = 0.12 sec.			274.899	$[M-COCl]^+$	PeCDF	
				290.894	$[M-COCl]^+$	PeCDD	
23.00	Begin temp. program to 235°	220	5	337.863	$[M]^+$	PeCDF	0.61
26.00	Column temperature hold	235		339.860	$[M+2]^+$	PeCDF	
				353.858	$[M]^+$	PeCDD	0.61
				355.855	$[M+2]^+$	PeCDD	
				407.801	$[M]^+$	HpDPE^a.	
32.00	Stop Penta Program						
32.50	Start Hexa Program; sweep = 350 ppm; time/mass = 0.20 sec.	235		310.857	$[M-COCl]^+$	HxCDF	
				326.852	$[M-COCl]^+$	HxCDD	
				373.821	$[M]^+$	HxCDF	1.23
				375.821	$[M+2]^+$	HxCDF	
				385.861	$[M]^+$	${}^{13}C_{12}$-HxCDF	
				389.816	$[M]^+$	HxCDD	1.23
				391.813	$[M+2]^+$	HxCDD	
				411.856	$[M]^+$	${}^{13}C_{12}$-HxCDD	
				443.759	$[M]^+$	ODPE^a.	

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TABLE 1. Sequence of Operations in GC-MS-DS Quantitation of CDDs/CDFs in Extracts of Environmental Samples* (Cont.)

Elapsed Time (min)	Event	GC Column Temperature (°C)	Temperature Program Rate (°C/min)	Ions Monitored by Mass Spectrometer (m/z)	Identity of Fragment Ion	Compounds Monitored	Approximate Theoretical Ratio of $[M]^+:[M+2]^+$
33.00	Begin temp. program to 250°C	235	5				
36.00	Column temperature hold	250					
42.50	Stop Hexa Program						
43.00	Start Hepta Program; sweep = 350 ppm; time/mass = 0.30 sec.	250		344.818	$[M-COCl]^+$	HpCDF	
				360.813	$[M-COCl]^+$	HpCDD	
				407.702	$[M]^+$	HpCDF	1.03
				409.779	$[M+2]^+$	HpCDF	
				423.777	$[M]^+$	HpCDD	1.03
				425.774	$[M+2]^+$	HpCDD	
				477.720	$[M^+]$	NDPE[a].	
53.00	Stop Hepta Program	250					
53.50	Start Octa Program; sweep = 350 ppm; time/mass = 0.30 sec.	250		378.768	$[M-COCl]^+$	OCDF	
				394.774	$[M-COCl]^+$	OCDD	
54.00	Begin temp. program to 270°	250*	5	441.732	$[M]^+$	OCDF	0.88
58.00	Column temperature hold	270*		443.740	$[M+2]^+$	OCDF	
				453.772	$[M]^+$	$^{13}C_{12}$-OCDF	
				457.738	$[M]^+$	OCDD	0.88
				459.735	$[M+2]^+$	OCDD	
				469.779	$[M]^+$	$^{13}C_{12}$-OCDD	
				471.776	$[M+2]^+$	$^{13}C_{12}$-OCDD	
				511.681	$[M]^+$	DDPE[a].	
65.00	Stop Octa Program						
65.00	Begin temp. program to 300°	270*	5				
71.00	Column temperature hold	300*					
75.00	Cool Column to 190°						

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[a] HxDFE, HpDPE, ODPE, NDPE, DDPE are abbreviations which designate (respectively) hexachloro-, heptachloro-, octachloro-, nonachloro-, and decachlorodiphenyl ethers.

*The parameters given here are applicable for a 60-meter fused silica capillary GC column coated with DB-5.

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APPENDIX

RECOMMENDED SAFETY AND HANDLING PROCEDURES FOR LABORATORIES CONDUCTING PCDD/PCDF ANALYSES

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Recommended Safety and Handling Procedures in Connection with Implementing the Analytical Protocal for Determination of PCDD/PCDF in Combustion Products

1. The human toxicology of PCDD/PCDF is not well defined at present, although the 2,3,7,8-TCDD isomer has been found to be acnegenic, carcinogenic, and teratogenic in the course of laboratory animal studies. The 2,3,7,8-TCDD is a solid at room temperature, and has a relatively low vapor pressure. The solubility of this compound in water is only about 200 parts-per-trillion, but the solubility in various organic solvents ranges from about 0.001% to 0.14%. The physical properties of the 135 other tetra-through octachlorinaed PCDD/PCDF have not been well established, although it is presumed that the physical properties of these congeners are generally similar to those of the 2,3,7,8-TCDD isomer. On the basis of the available toxicological and physical property data for TCDD, this compound, as well as the other PCDD and PCDF, should be handled only by highly trained personnel who are thoroughly versed in the appropriate procedures, and who understand the associated risks.

2. PCDD/PCDF and samples containing these are handled using essentially the same techniques as those employed in handling radioactive or infectious materials. Well-ventilated, controlled-access laboratories are required, and laboratory personnel entering these laboratories should wear appropriate safety clothing, including disposable coveralls, shoe covers, gloves, and face and head masks. During analytical operations which may give rise to aerosols or dusts, personnel should wear respirators equipped with activated carbon filters. Eye protection equipment (preferably full face shields) must be worn at all times while working in the analytical laboratory with PCDD/PCDF. Various types of gloves can be used by personnel, depending upon the analytical operation being accomplished. Latex gloves are generally utilized, and when handling samples thought to be particularly hazardous, an additional set of gloves are also worn beneath the latex gloves is (for example, Playtex gloves supplied by American Scientific Products, Cat. No. 67216). Bench-tops and other work surfaces in the laboratory should be covered with plastic-backed absorbent paper during all analytical processing. When finely divided samples (dusts, soils, dry chemicals) are being processed, removal of these from sample containers, as well as other operations, including weighing, transferring, and mixing with solvents, should all be accomplished within a glove box. Glove boxes, hoods and the effluents from mechanical vacuum pumps and gas chromatographs on the mass spectrometers should be vented to the atmosphere preferably only after passing through HEPA particulate filters and vapor-sorbing charcoal.

3. All laboratory ware, safety clothing and other items potentially contaminated with PCDD/PCDF in the course of analyses must be carefully secured and subjected to proper disposal. When feasible, liquid wastes

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are concentrated, and the residues are placed in approved steel hazardous waste drums fitted with heavy gauge polyethylene liners. Glass and combustible items are compacted using a dedicated trash compactor used only for hazardous waste materials and then placed in the same type of disposal drum. Disposal of accumulated wastes is periodically accomplished by high temperature incineration at EPA-approved facilities.

4. Surfaces of laboratory benches, apparatus and other appropriate areas should be periodically subjected to surface wipe tests using solvent-wetted filter paper which is then analyzed to check for PCDD/PCDF contamination in the laboratory. Typically, if the detectable level of TCDD or TCDF from such a test is greater than 50ng/m^2, this indicates the need for decontamination of the laboratory. A typical action limit in terms of surface contamination of the other PCDD/PCDF (summed) is 500ng/m^2. In the event of a spill within the laboratory, absorbent paper is used to wipe up the spilled material and this is then placed into a hazardous waste drum. The contaminated surface is subsequently cleaned thoroughly by washing with appropriate solvents (methylene chloride followed by methanol) and laboratory detergents. This is repeated until wipe tests indicate that the levels of surface contamination are below the limits cited.

5. In the unlikely event that analytical personnel experience skin contact with PCDD/PCDF or samples containing these, the contaminated skin area should immediately be thoroughly scrubbed using mild soap and water. Personnel involved in any such accident should subsequently be taken to the nearest medical facility, preferably a facility whose staff is knowledgable in the toxicology of chlorinated hydrocarbons. Again, disposal of contaminated clothing is accomplished by placing it in hazardous waste drums.

6. It is desirable that personnel working in laboratories where PCDD/PCDF are handled be given periodic physical examinations (at least yearly). Such examinations should include specialized tests, such as those for urinary porphyrins and for certain blood parameters which, based upon published clinical observations, are appropriate for persons who may be exposed to PCDD/PCDF. Periodic facial photographs to document the onset of dermatologic problems are also advisable.

APPENDIX N

PERSONNEL

EPA

Project Officer: James D. Kilgroe
OAQPS Task Manager: Gene Riley
AEERL Program Coordinator: Ted Brna
OAQPS Program Coordinator: Mike Johnston

Radian

Process Monitoring: Winton Kelly

KTI/MERC

Vice President of Operations: Lynn Johnston
Manager of Environmental Affairs: Frank Ferraro
Plant Engineer: Gary Bates
Assistant Director of Operations: Steve Davis

Entropy Environmentalists, Inc.

HCl Test Project Coordinator: Ron Jernigan
HCl Test Team Leader: Scott Shanklin
HCl Test Sampling: Keith Hazel

Midwest Research Institute

Program Manager/Field Setup Support: Roy Neulicht
Project Leader/CEM Operations: George Scheil
Field Crew Chief: Jim Surman
Organics Analytical Task Leader: Marilyn Whitacre
Metals Analytical Task Leader: Eileen McClendon
Inlet Metals Sampling: Steve Cummins
Inlet Organics Sampling: Scott Klamm
Inlet Site Assistant: Steve Schliesser
Outlet Metals Sampling: Dave Griffin
Outlet Organics Sampling: Dan March
Outlet Site Assistant: Dan Soderberg
CEM Operations: Laurie Cone
Process Effluent Sampling: Randy Nelson
Laboratory: Laura Kinner

Metals Laboratory

Maurene Greene
Nancy Friederich

Organics Laboratory

John Coates, Program Manager
Nancy Soutor
Kelly Addison
Pam Perkins
Joe Palausky
Mike Molloy

TABLE OF CONVERSION FACTORS

Multiply English units	By	To obtain SI units
lb/h	4.536×10^{-1}	kg/h
gr/dscf	2.288×10^{9}	ng/dscm
gr/dscf	2.288×10^{3}	mg/dscm
foot	0.3048	meter
inch	2.54	centimeter
tons/day	0.907	mg/day
gallon	3.785	liter
Btu/h	1.05488	MJ/h
ft^3/min	28316.8	cm^3/min
inches H_2O	0.0394	mm H_2O